

3.14 Installation of an oil expansion tank, Option OA

The expansion tank must be installed vertically with the hose connection facing downwards and the vent plug upwards. Please note the attached factory standard 0-530-04 for the installation.

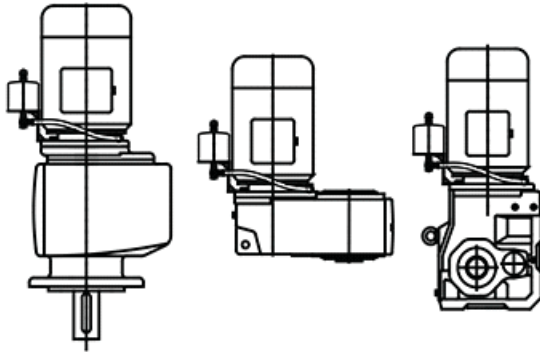


Figure 19: Installing the expansion tank

3.15 Subsequent paintwork

NOTICE

Damage to the device

For retrospective painting of the gear unit, the radial seals, rubber elements, pressure venting valves, hoses, type plates, adhesive labels and motor coupling components must not come into contact with paints, lacquers or solvents, as otherwise components may be damaged or made illegible.

4 Commissioning

4.1 Check the oil level

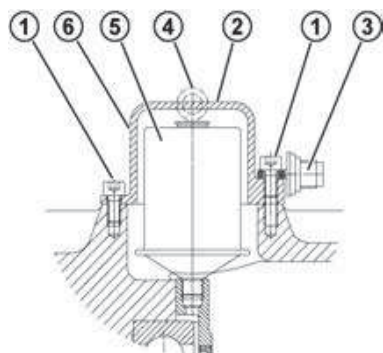
The oil level must be checked prior to commissioning (please see chapter 5.2 "Service and Maintenance Work").

4.2 Activating the automatic lubricant dispenser

Some gear unit types with standard motor (Option IEC/NEMA) have an automatic lubricant dispenser for the roller bearings. This dispenser must be activated prior to commissioning. The cartridge case cover of the adapter for attaching an IEC/NEMA standard motor has a red information sign for the activation of the lubricant dispenser. A grease escape opening which is closed with a G1/4 cap screw is located opposite to the lubricant dispenser. After activation of the lubricant dispenser, the cap screw can be removed and replaced with the grease collection container (Part No. 28301210) which is supplied separately with the delivery.

Activating the automatic lubricant dispenser:

1. Loosen and remove the cylindrical screws.
2. Remove the cartridge cover.
3. Screw the activation screw into the lubricant dispenser until the lug breaks off at the defined fracture point
4. Re-fit the cartridge cover and fasten it with the cylindrical screw (please see chapter 6.5 "Torque values").
5. Mark activation date on the adhesive label indicating the month/year



Explanation

- | | |
|---|----------------------------|
| 1 | Cylindrical screw M8 x 16 |
| 2 | Cartridge cover |
| 3 | Activation screw |
| 4 | Lug |
| 5 | Lubricant sensor |
| 6 | Position of adhesive label |

Figure 20: Activating the automatic lubricant dispenser with standard motor mounting

Adhesive label:

Notice!

Screw in the activation screw until the lug breaks off before commissioning the gear unit.

Dispensing time: 12 Months

Month	Activation date	Year
1 2 3 4 5 6 7 8 9 10 11 12		06 07 08 09 10
		11 12 13 14 15

Figure 21: Adhesive label

4.3 Operation with lubricant cooling

Water cooling

NOTICE

Gear unit damage

The gear unit may be damaged by overheating.

The drive may only be commissioned after the cooling spiral has been connected to the cooling circuit, and the cooling circuit has been put into operation.

The coolant must have a similar thermal capacity as water (specific thermal capacity at 20°C $c=4.18 \text{ kJ/kgK}$). Industrial water without any air bubbles or sediments is recommended as a coolant. The hardness of the water must be between 1 dH and 15 dH; the pH value must be between pH 7.4 and pH 9.5. No aggressive liquids may be added to the coolant!

The **coolant pressure** must not exceed **8 bar**. The required **quantity of coolant** is **10 litres/minute**, and the **coolant inlet temperature** must not exceed 40°C; we recommend **10°C**.

We also recommend fitting a pressure reducer or similar at the coolant inlet to avoid damage due to excessive pressure.

If there is a danger of frost the operator should add a suitable anti-freeze solution to the cooling water.

The **temperature of the cooling water** and the **cooling water flow rate** must be supervised and ensured by the operator.

Air/Oil cooler

The version and all important data for the air/oil cooler can be obtained from Catalogue G1000, or contact the manufacturer of the cooling unit.

4.4 Running-in time for the worm gear unit



Information

Running-in time

In order to achieve maximum efficiency of the worm gear unit, the gear unit must be subjected to a running-in period of approx. 25 h – 48 h under maximum load.

There may be a reduction in efficiency before the running-in period is complete.

4.5 Checklist

Checklist		
Subject of check	Date checked:	Information see Section
Is the vent plug activated or the pressure vent screwed in?		3.4
Does the required configuration conform with the actual installation?		6.1
Are the external gear shaft forces within permitted limits (chain tension)?		3.6
Is the torque support correctly fitted?		3.7
Are contact guards fitted to rotating components?		3.9
Is the automatic lubricant dispenser activated?		4.2
Is the cooling cover connected to the cooling circuit?		3.13 4.3

5 Service and maintenance



WARNING

Danger of burns

The surfaces of gear units or geared motors may become hot during or shortly after operation.

- Installation and maintenance work must only be performed when gear unit is at a standstill and has cooled down. The drive must be isolated and secured to prevent accidental start-up.
- Wear protective gloves.
- Shield hot surfaces with contact guards.

5.1 Service and Maintenance Intervals

Service and Maintenance Intervals	Service and Maintenance Work	Information see Section
At least every six months	<ul style="list-style-type: none"> • Visual inspection • Check for running noises • Check the oil level • Re-grease / remove excess grease (only applicable for free drive shaft / Option W and for agitator bearings / Option VL2 / VL3) • Replace the automatic lubricator / remove excess grease (for operating times < 8 h / day): (A replacement interval of 1 year is permissible for the lubricant dispenser) (Only for IEC / NEMA standard motor mounting). Empty or replace the lubricant collection container with every second replacement of the lubricant dispenser. 	5.2
For operating temperatures up to 80 °C every 10000 operating hours, at least every 2 years	<ul style="list-style-type: none"> • Change the oil (The interval is doubled if filled with synthetic products) • Cleaning or replacing the vent plug • Replace shaft sealing rings if worn 	5.2
Every 20000 operating hours, at least every 4 years	<ul style="list-style-type: none"> • Re-lubrication of the bearings in the gear unit 	5.2
At least every 10 years	<ul style="list-style-type: none"> • General overhaul 	5.2

Information

Oil change intervals

The oil change intervals apply for normal operating conditions and operating temperatures up to 80 °C. The oil change intervals are reduced in the case of extreme conditions (operating temperatures higher than 80 °C, high humidity, aggressive environment and frequent fluctuations in the operating temperature).

5.2 Service and Maintenance Work

WARNING

Severe personal injury

Severe injury and material damage may be caused by incorrect servicing and maintenance work.

Servicing and maintenance work must only be performed by qualified specialist personnel. Wear the necessary protective clothing for servicing and maintenance work (e.g. industrial footwear, protective gloves, goggles, etc.)

WARNING

Severe personal injury

Risk of injury due to rapidly rotating and hot machine components.

Installation and maintenance work must only be performed when gear units are at a standstill and have cooled down. The drive must be isolated and secured to prevent accidental start-up.

WARNING

Severe personal injury

Particles or liquids thrown up during servicing and maintenance can cause injuries.

- Observe the safety information when cleaning with compressed air or a pressure washer.

WARNING

Danger of burns

Danger of burns due to hot oil.

- Allow the gear unit to cool down before carrying out maintenance or repair work.
- Wear protective gloves.

NOTICE

Leaks

Take care that no dirt or water enters the shaft sealing rings or the vents when cleaning

Dirt or water in the shaft sealing rings may cause leaks.

Visual inspection

The gear unit must be checked for leaks. In addition, the gear unit must be inspected for external damage and cracks in the hoses, hose connections and rubber buffers. Have the gear unit repaired in case of leaks, e.g. dripping gear oil or cooling water, damage or cracks. Please contact the NORD service department.

i Information

Shaft sealing rings

Shaft sealing rings are rubbing seals and have sealing lips made from an elastomer material. These sealing lips are lubricated with a special grease at the factory. This reduces the wear due to their function and ensures a long service life. An oil film in the region of the rubbing sealing lip is therefore normal and is not due to leakage. (please see chapter 6.7 "Leaks and seals")

Check for running noises

If the gear unit produces unusual running noises and/or vibrations, this could indicate damage to the gear unit. In this case the gear should be shut down and a general overhaul carried out.

Check the oil level

Section 6.1 "Configurations and maintenance" describes the versions and the corresponding oil level screws. With double gear units, the oil level must be checked on both units. The pressure vent must be at the position marked in Section 6.1 "Configurations and maintenance" Bauformen und Wartung</dg_ref_source_inline>.

The oil level does not need to be checked on gear units without oil level screw (please see chapter 6.1 "Configurations and maintenance").

Gear unit types that are not supplied full of oil must be filled before the oil level is checked.

Check the oil level with an oil temperature of between 20 °C to 40 °C.

1. The oil level may only be checked when the gear unit is at a standstill and has cooled down. The gear unit must be secured to prevent accidental switch-on.
2. The oil level screw corresponding to the version must be screwed out (please see chapter 6.1 "Configurations and maintenance").

i Information

Checking the oil level

At the first oil level check a small amount of oil may escape, as the oil level may be below the lower edge of the oil level hole.

3. **Gear units with oil level screw:** The correct oil level is at the lower edge of the oil level hole. If the oil level is too low, this must be corrected using the correct type of oil. An oil level glass is available instead of the oil level screw
4. **Gear units with an oil level tank:** The oil level must be checked in the oil level tank with the aid of the dipstick plug (thread G1 1/4). The oil level must be between the upper and lower marking when the dipstick is fully screwed in (see Figure 22). Top up the oil level with the relevant type of oil as necessary. These gearboxes may only be operated in the configuration stated in Section 6.1 "Configurations and maintenance".
5. The oil level screw or the cap screw with dipstick and all other loosened screws must be correctly re-tightened.

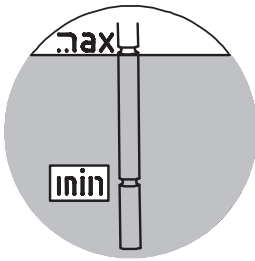


Figure 22: Checking the oil level with a dipstick

Re-greasing

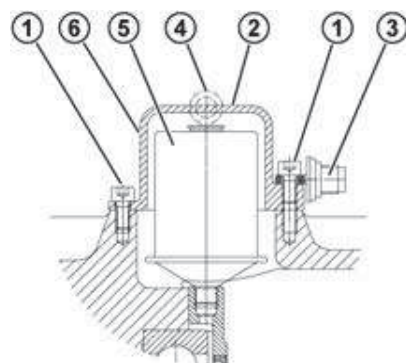
Some gear unit designs (free drive shaft, Option W, agitator designs VL2 and VL3) are equipped with a re-greasing device.

For agitator versions VL2 and VL3, the vent screw located opposite to the grease nipple must be unscrewed before re-greasing. Grease should be injected until a quantity of 20 - 25 g escapes from the vent hole. After this, the vent plug must be reinserted and tightened.

For Option W and some IEC adapters, the outer roller bearing must be re-greased with approx. 20 - 25 g of grease via the grease nipple provided. Remove any excess grease from the adapter.

Recommended grease: Petamo GHY 133N (please see chapter 6.2 "Lubricants") (Fa. Klüber Lubrication).

Replacing the automatic lubricant dispenser



Explanation

- 1 Cylindrical screws M8 x 16
- 2 Cartridge cover
- 3 Activation screw
- 4 Lug
- 5 Lubricant sensor
- 6 Position of adhesive label

Figure 23: Replacing the automatic lubricant dispenser with standard motor mounting

The cartridge cover must be unscrewed. The lubrication dispenser is screwed out and replaced with a new component (Part No. 283 0100). Remove any excess grease from the adapter. Then activate (please see chapter 4.2 "Activating the automatic lubricant dispenser").

Empty or replace the grease collection container (Part No. 28301210) with every second replacement of the lubricant container. To empty the container, unscrew it from the screw fitting. The container has an internal piston, which can be pressed back with a rod with a maximum diameter of 10 mm. Collect the grease which is pressed out and dispose of it correctly. Due to the shape of the container, a residual quantity of grease remains in the container. After emptying and cleaning the container, it can be screwed back into the drain hole in the IEC adapter. Replace the container with a new one if it is damaged.

Change the oil

The figures in Section 6.1 "Configurations and maintenance" show the oil drain screw, the oil level screw and the pressure vent screw for various designs.

Procedure:

1. Place a catchment vessel under the oil drain screw or the oil drain cock.
2. Completely remove the oil level screw or screwed sealing plug with dipstick if an oil level tank is being used and unscrew oil drain screw.



WARNING

Danger of burns

Danger of burns due to hot oil.

- Allow the gear unit to cool down before carrying out maintenance or repair work.
- Wear protective gloves.

3. Drain all the oil from the gear unit.
4. If the sealing ring of the oil drain screw or oil level screw is damaged in the thread, a new oil level screw must be used or the thread must be cleaned and coated with securing lubricant, e.g. Loctite 242, Loxeal 54-03 prior to insertion.
5. Screw the oil drain screw into the hole and tighten to the correct torque (please see chapter 6.5 "Torque values").
6. Using a suitable filling device, refill with oil of the same type through the oil level hole until oil emerges from the oil level hole. (The oil can also be filled through the pressure vent screw or a sealing plug located higher than the oil level). If an oil level tank is used, fill the oil through the upper inlet (thread G1¼) until the oil level is set as described in Section 5.2 "Service and Maintenance Work".
7. Wait at least 15 minutes, or at least 30 minutes if an oil level tank is used, and then check the oil level. Proceed as described in Section 5.2 "Service and Maintenance Work".

Information

Oil level

The oil does not need to be changed on gear units without oil level screw (please see chapter 6.1 "Configurations and maintenance"). These gear units are lubricated for life.

Standard helical gear units have no oil level screw. Here, the oil is topped up through the pressure vent bolt using the quantities listed in the table in Section 6.4 "Helical gear unit".

Cleaning or replacing the vent plug

Unscrew the vent screw and thoroughly clean it (e.g. with compressed air) and fit the vent screw in the same place. If necessary, use a new vent screw with a new sealing ring.

Replace the shaft sealing ring

Once the shaft sealing ring has reached the end of its service life, the oil film in the region of the sealing lip increases and a measurable leakage with dripping oil occurs. **The shaft sealing ring must then be replaced.** The space between the sealing lip and the protective lip must be filled approximately 50 % with grease on fitting (recommended grease: PETAMO GHY 133N). Take care that after fitting, the new shaft sealing ring does not run in the old wear track.

Re-lubricating bearings

For bearings which are not oil-lubricated and whose holes are completely above the oil level, replace the roller bearing grease (recommended grease: PETAMO GHY 133N). Please contact the NORD service department.

General overhaul

For this, the gear unit must be completely dismantled. The following work must be carried out:

- Clean all gear unit components
- Examine all gear unit components for damage
- All damaged components must be replaced
- All roller bearings must be replaced
- Replace back stops if fitted
- Replace all seals, radial seals and Nilos rings
- Replace plastic and elastomer components of the motor coupling

The general overhaul must be carried out by qualified personnel in a specialist workshop with appropriate equipment in observance of national regulations and laws. We recommend that the general overhaul is carried out by the NORD Service department.

6 Appendix

6.1 Configurations and maintenance

Explanation of symbols for the following version illustrations:



Venting



Oil level



Oil drain



Information

Gear unit - Lubrication

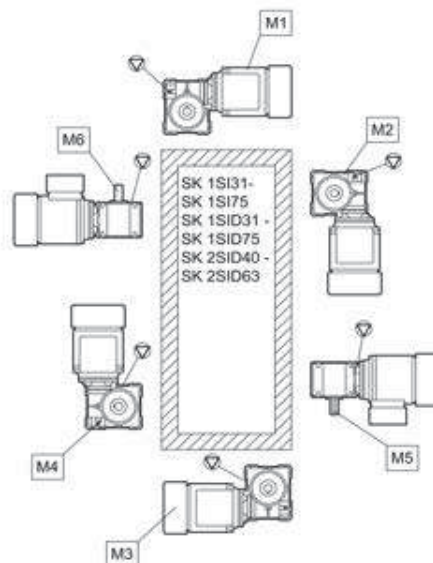
SK 320, SK 172, SK 272, SK 372 as well as SK 273 and SK 373, SK 01282 NB, SK 0282 NB, SK 1382 NB and UNIVERSAL / MINIBLOC gear units are lubricated for life. These gear units do not have an oil filler screw.

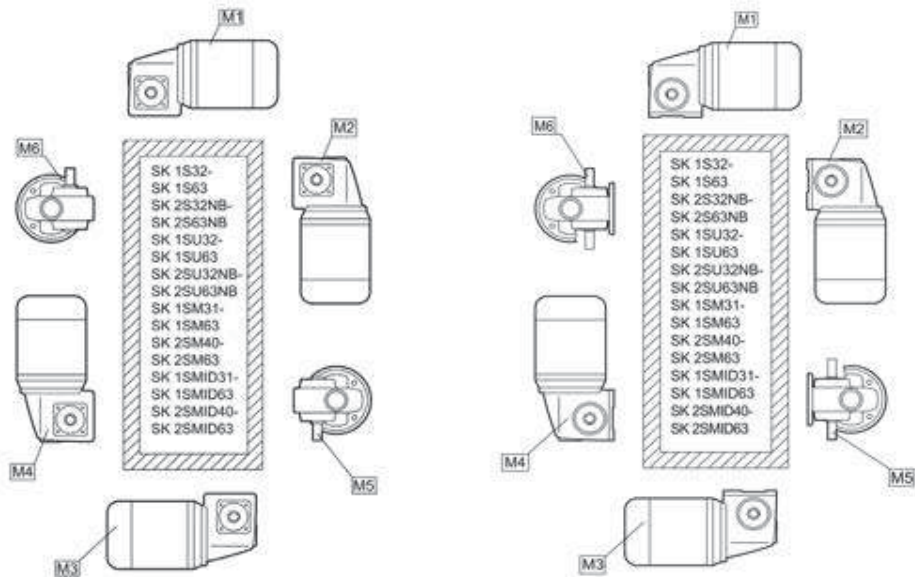
UNIVERSAL / MINIBLOC worm gear units

NORD UNIVERSAL / MINIBLOC worm gear units are suitable for all installation positions. They have an oil filler which is independent of the configuration.

As an option, types SI and SMI can be equipped with a vent screw. Gear units with vents must be installed in the stated position.

Types SI, SMI, S, SM and SU as 2-stage gear unit types and types SI, SMI as worm gear units for direct motor mounting have an oil filler which depends on the configuration and must be installed in the stated position.





Parallel shaft gear units with oil level tank

The following applies for SK 9282, SK 9382, SK 10282, SK 10382, SK 10382.1, SK 11282, SK 11382, SK 11382.1 and SK 12382 in the M4 configuration with oil level tank:

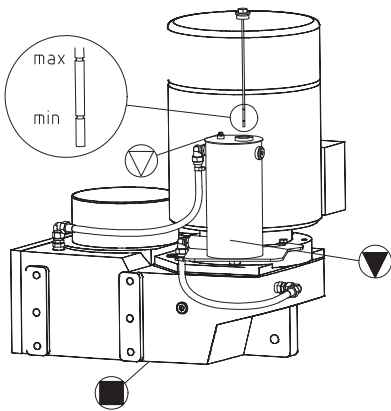
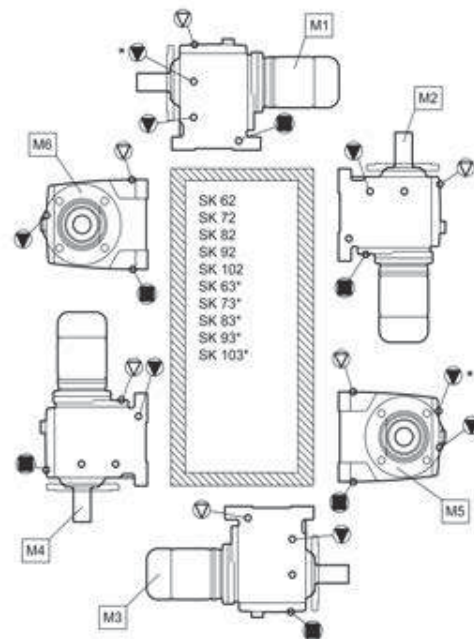
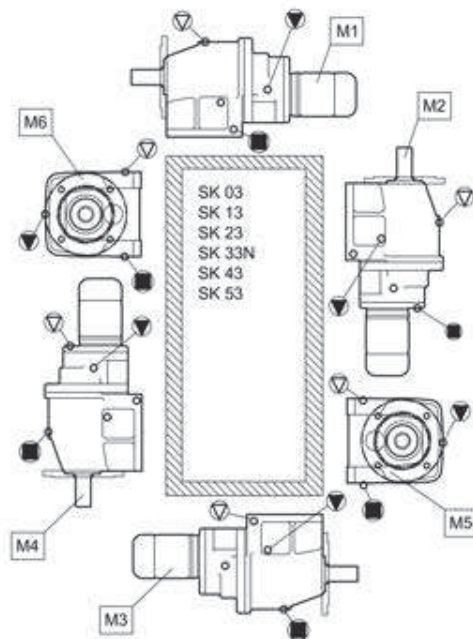
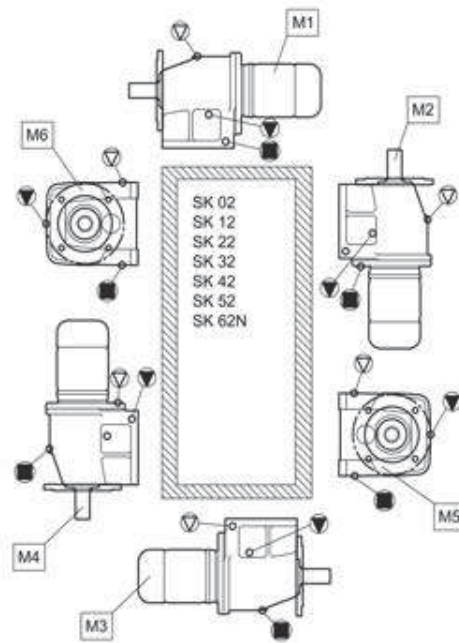
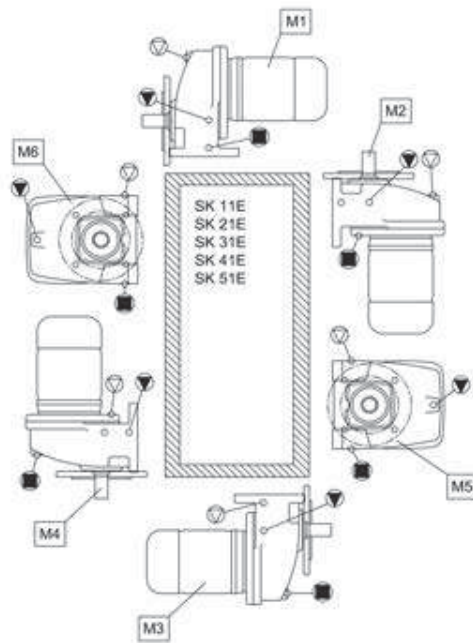
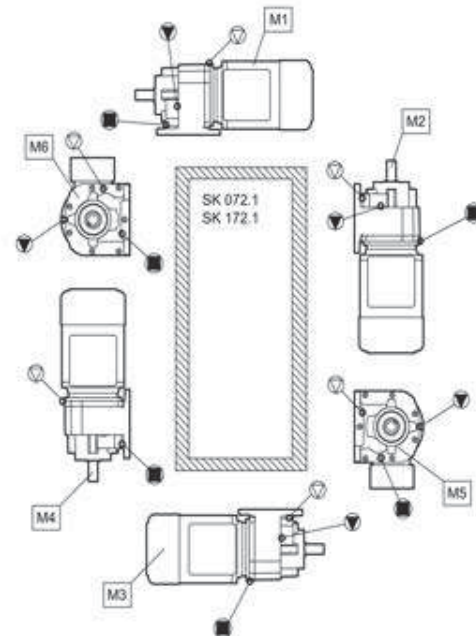
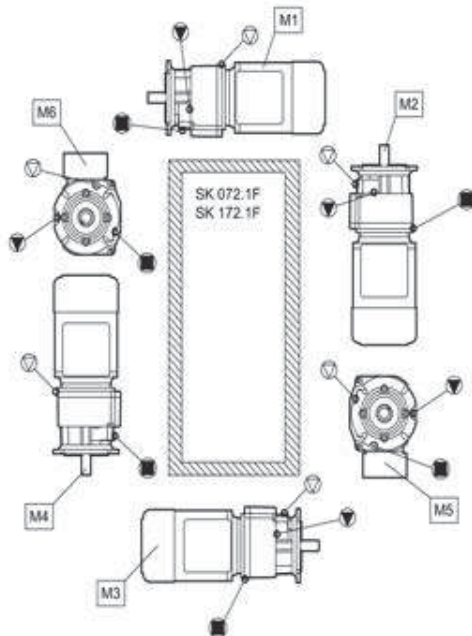
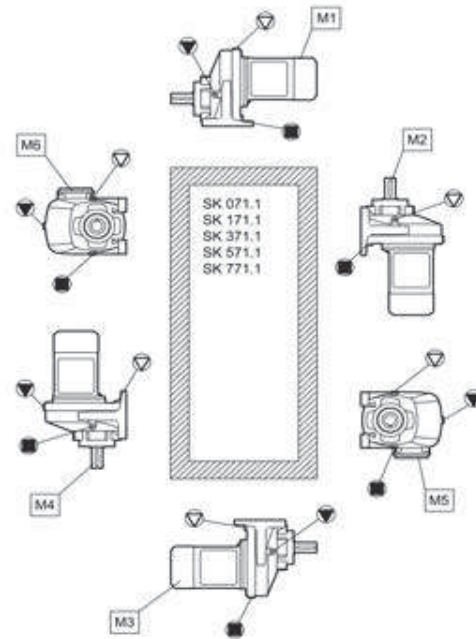
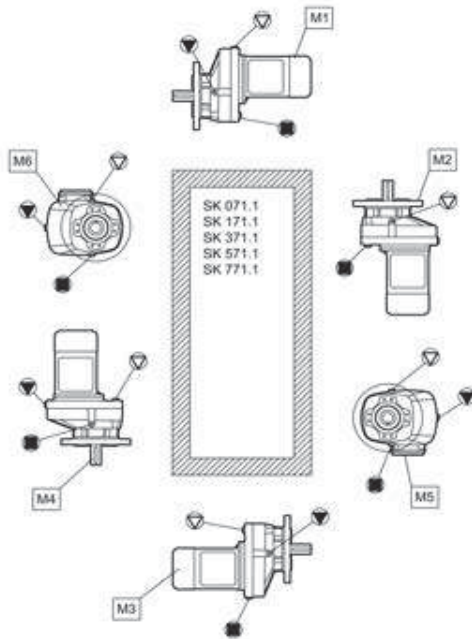
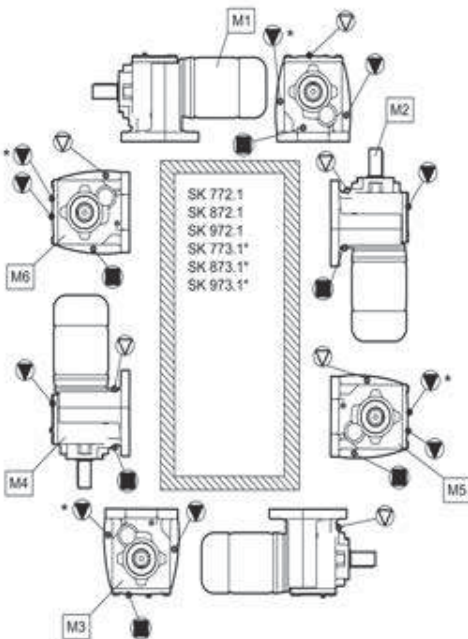
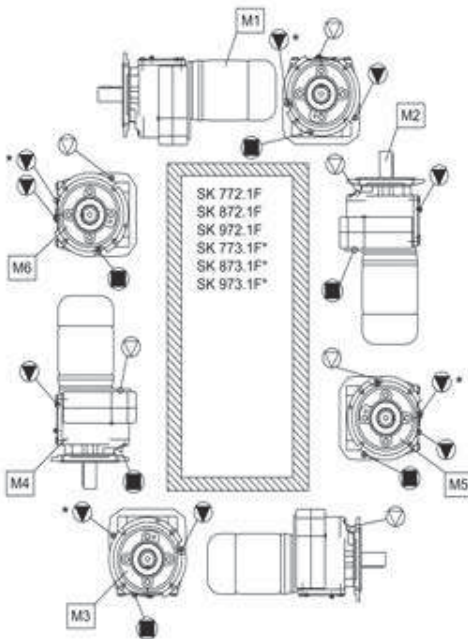
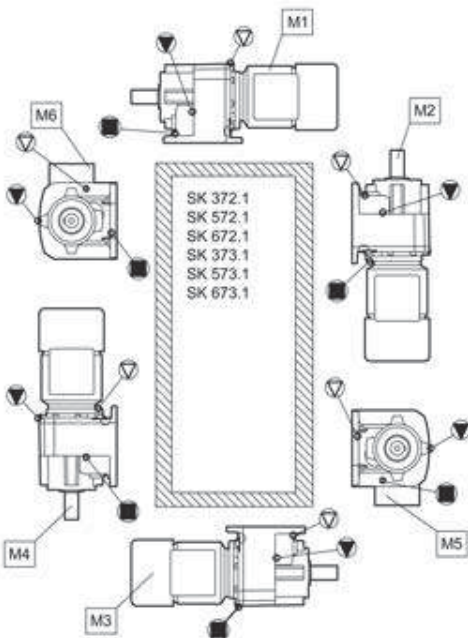
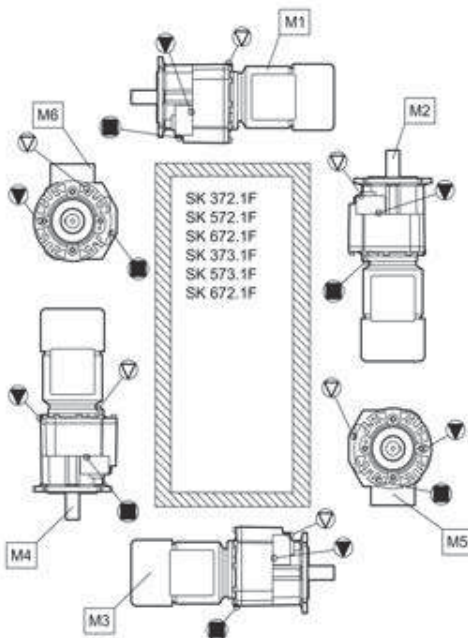
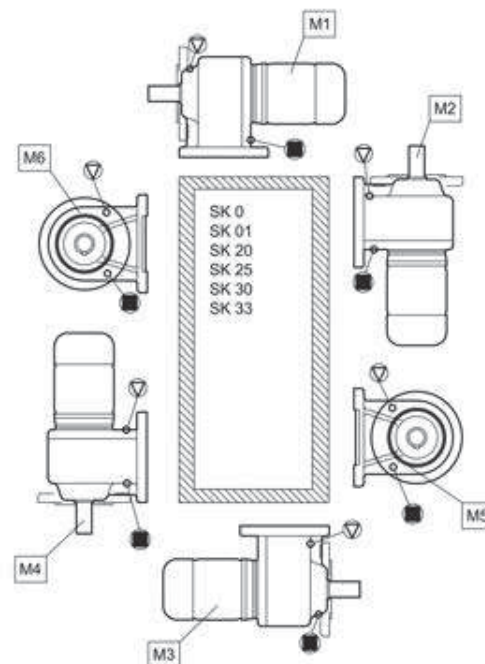
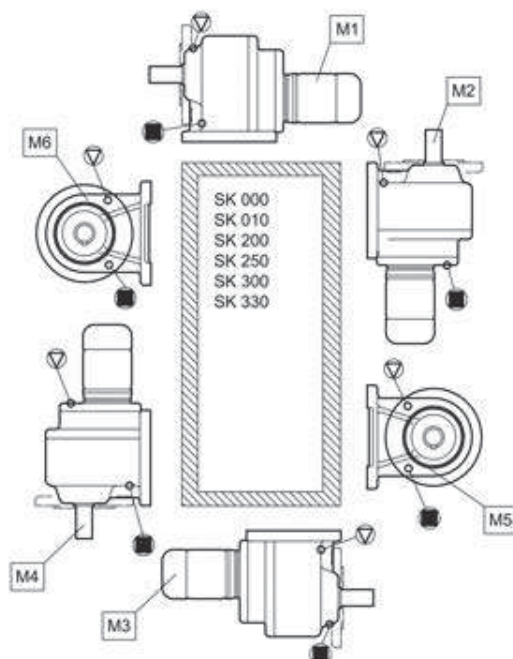
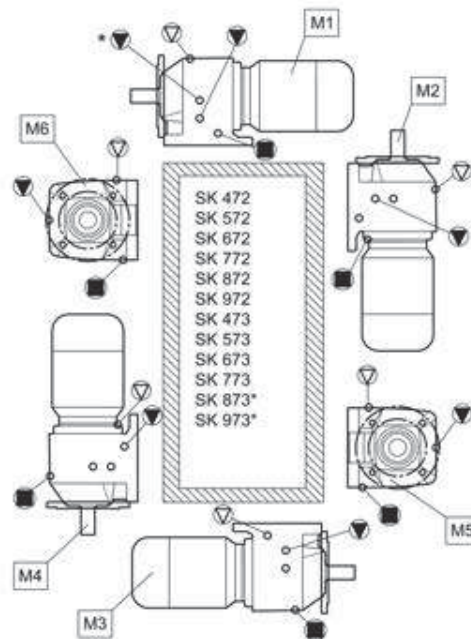


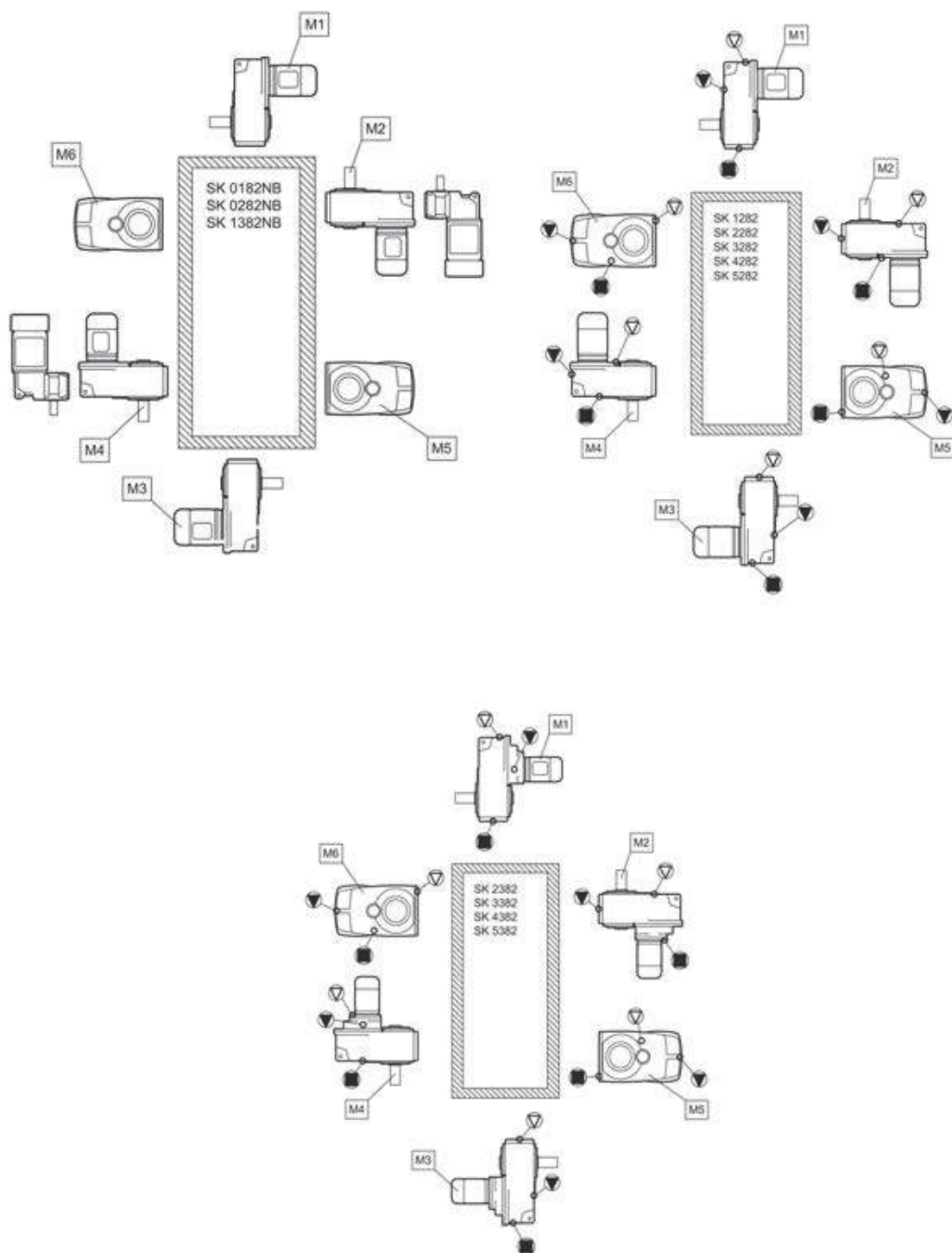
Figure 24: Oil level check with oil level tank

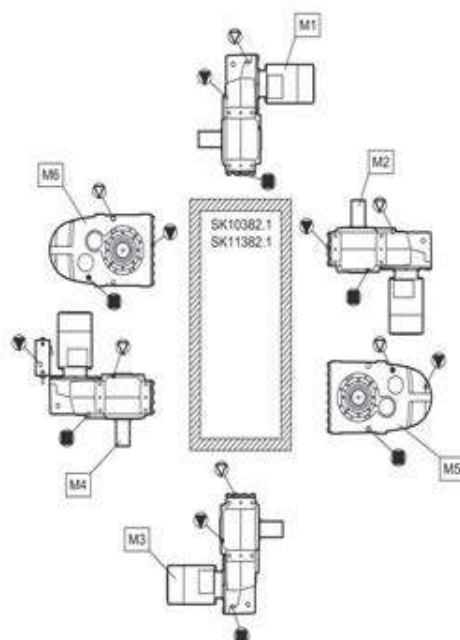
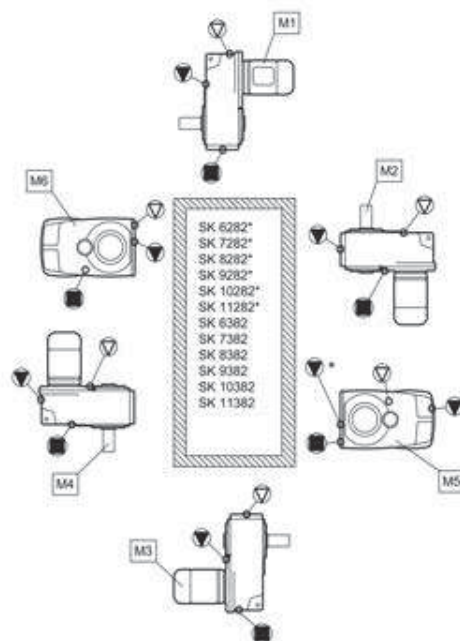


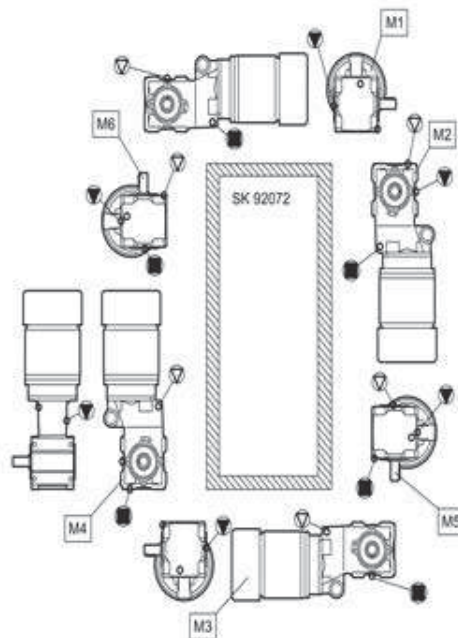
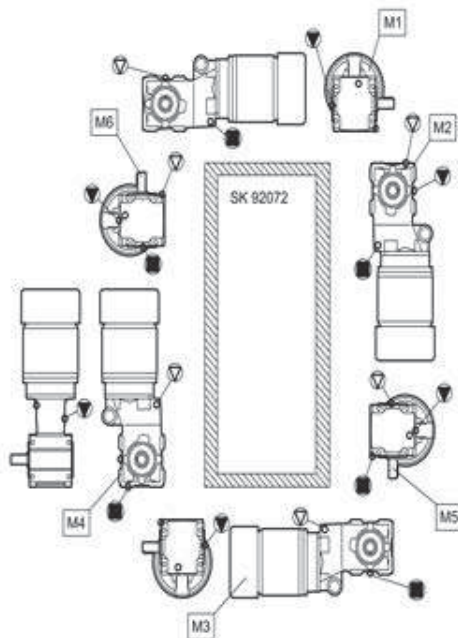
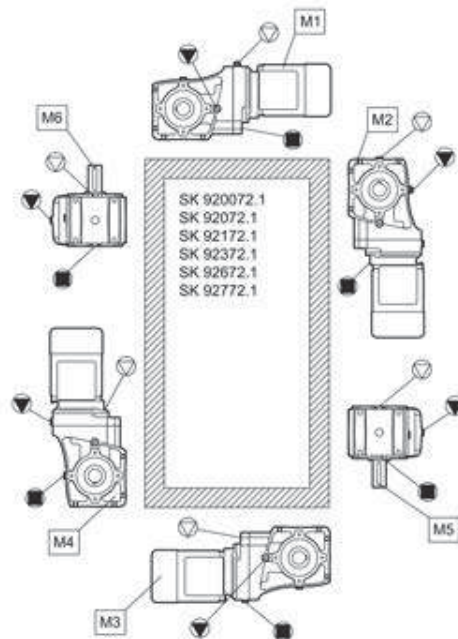
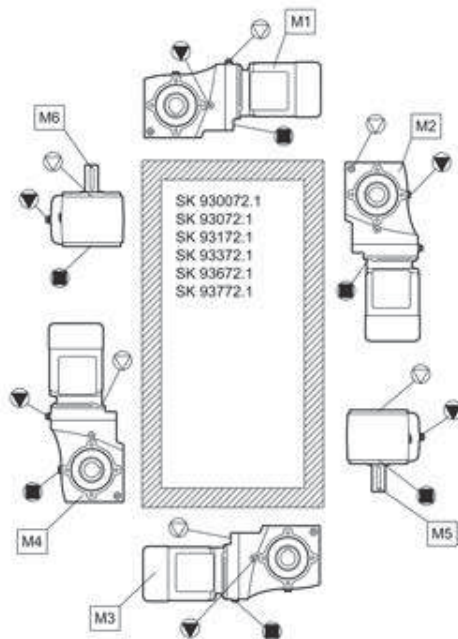


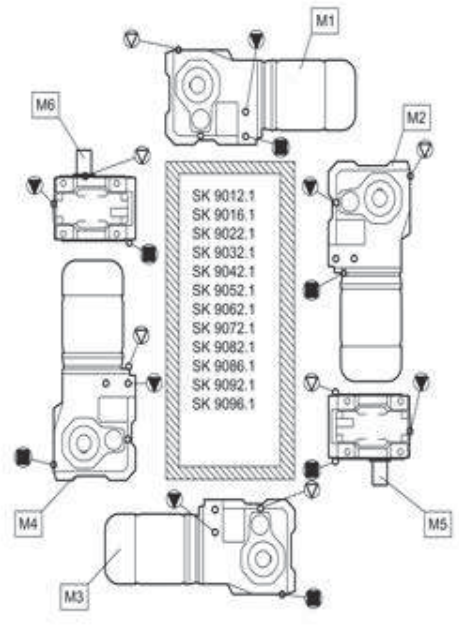
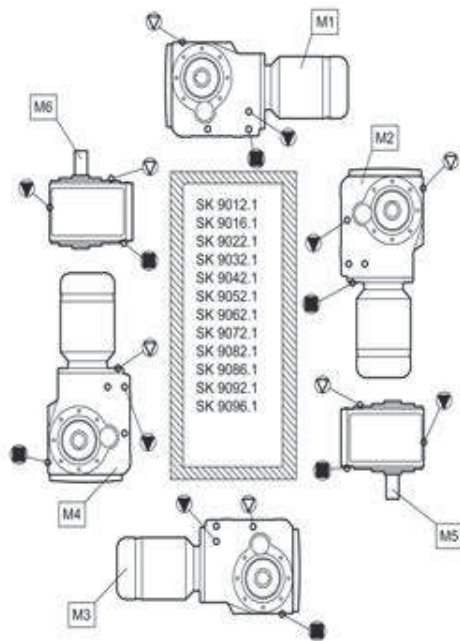
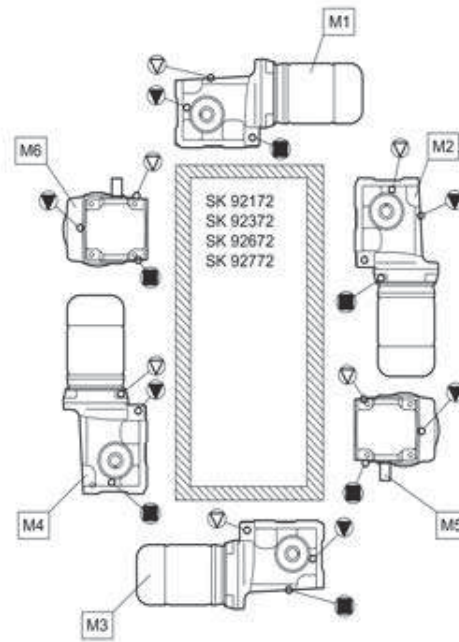
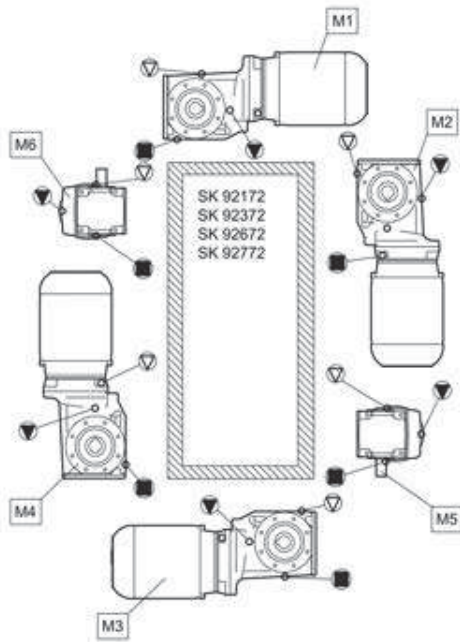


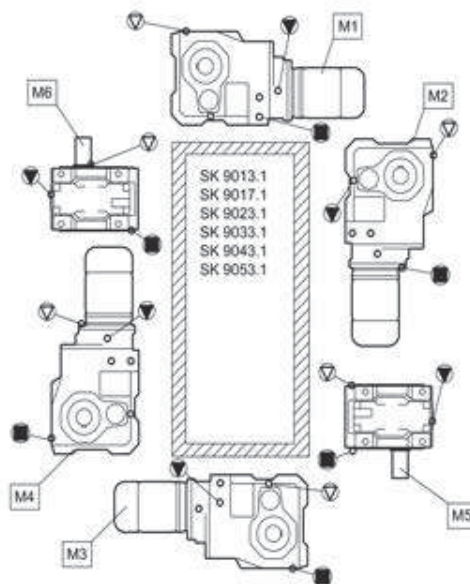
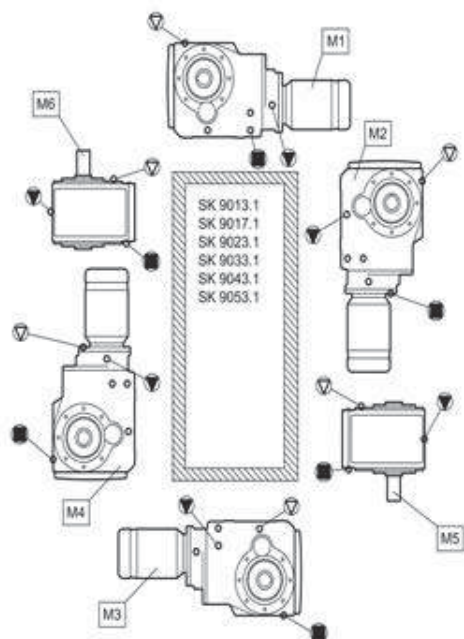


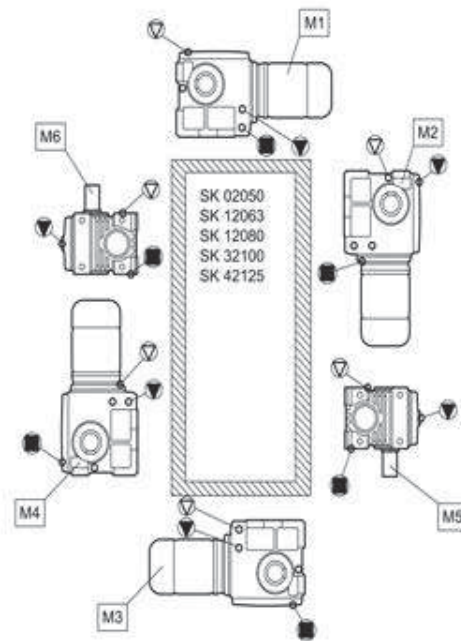
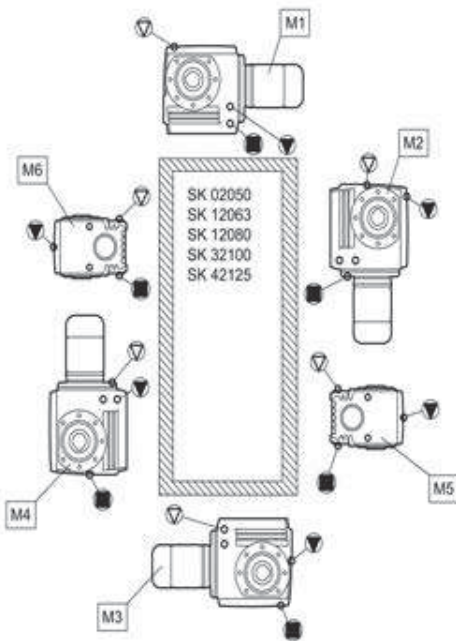
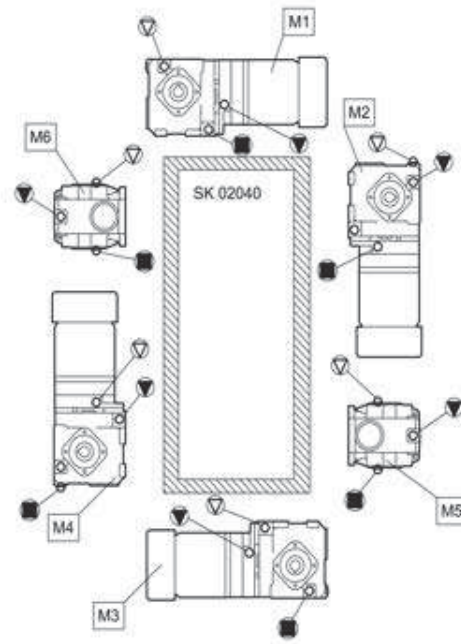
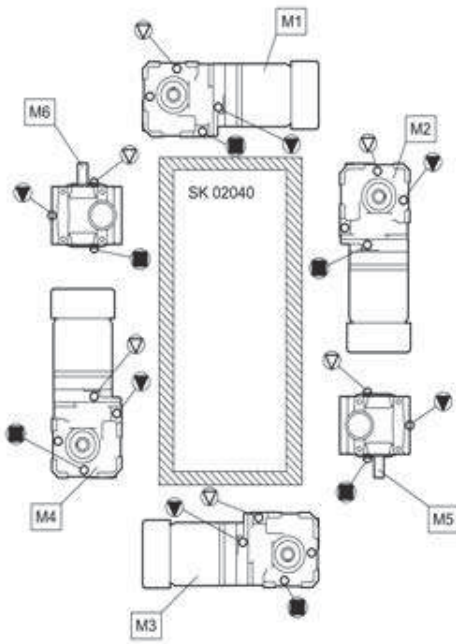












Remote Bulb Control (Continued)

Selection Charts (Continued)

Replacement Parts

Code Number	Description
CVR28A-617R	Concealed adjustment cover
CVR28A-618R	Visible scale cover
KNB20A-602R	Replacement Knob Kit

Accessories

A packing nut is available for closed tank application.
Specify the part number **FTG13A-600R**.

Bulb wells (WEL14A Series) are available for liquid immersion applications.
Refer to the selection chart or to *Bulb Wells Catalog Page, LIT-1922135*.

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120	208	240
Wide Range – Adjustable Differential			
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive A ¹	22 A, 120 to 277 VAC		
Pilot Duty – 125 VA, 24 to 600 VAC			
Fixed Differential and Close Differential			
AC Full Load A	6.0	3.4	3.0
AC Locked Rotor A	36.0	20.4	18.0
Non-Inductive A	10 A, 24 to 277 VAC		
Pilot Duty – 125 VA, 24 to 277 VAC			
Case Compensated – Fixed Differential A19AAC-4			
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive A ¹	22 A, 120 to 277 VAC		
Pilot Duty – 125 VA, 24 to 600 VAC			
A19AAD-12			
AC Full Load A	6.0	3.4	3.0
AC Locked Rotor A	36.0	20.4	18.0
Non-Inductive A	10 A, 24 to 277 VAC		
Pilot Duty – 125 VA, 24 to 277 VAC			
Manual Reset			
AC Full Load A	16.0	9.2	8.0
AC Locked Rotor A	96.0	55.2	48.0
Non-Inductive A	16.0	9.2	8.0
Pilot Duty – 125 VA, 24 to 600 VAC			

1. SPST and N.O. contact of SPDT control;
SPDT N.C. contact- 16 amps 120 to 277 VAC

TSLL/TSH - Switch, Temperature Thermostat, CN TF115-001
TSLL7911 - Switch, Temperature Thermostat, CN TF115-001
TSLL-7941 - Switch, Temperature Thermostat, CN TF115-001



AUTOMATION AND CONTROLS

NEMA 4X RAIN-TIGHT THERMOSTAT INSTALLATION AND OPERATING INSTRUCTIONS

INSTRUCCIONES DE INSTALACION Y OPERACION DEL THERMOSTATO A PRUEBA DE LLUVIA NEMA 4X

THERMOSTAT NEMA 4X ÉTANCHE AUX INTÉMPÉRIES INSTRUCTION D'INSTALLATION ET D'UTILISATION

WARNING

To prevent overheating or fire, use this control as an operating or regulating thermostat. ALWAYS USE A BACKUP CONTROL OR ALARM if a control failure could cause the controlled appliance to overheat or could cause a fire.

Where thermostat is capable of cycling directly between heating and cooling loads, failure to provide a load transfer switch will result in thermostat failure.

Do not install, use or operate if product appears damaged, the enclosure is cracked or broken or if the sensor has been bent, crimped or is dirty.

APPROPRIATE APPLICATION

This thermostat has been tested by CSA and Underwriters Laboratories Inc. (UL), meets the requirements for NEMA 4X equipment and is suitable for use under the National Electrical Code (NEC), Article 547-7, when used with appropriate watertight connectors (not included).

INSTALLATION

WARNING

To avoid electrical shock or damage to equipment, disconnect all power before installing or servicing.

To avoid potential fire and/or explosion, do not use in potentially flammable or explosive atmospheres.

Installation must be made by a trained, qualified service person in accordance with the National Electrical Code (NEC) and all applicable local codes and ordinances. Installation should meet all applicable national, state and local codes. Refer to the appropriate wiring diagram included. Locate the thermostat (local sensing models) or sensing bulb (remote sensing models) for optimum temperature sensing of the controlled space. Thermostat operation will be affected by unusual heat or cold, such as direct sunlight, near windows or doors or on outside walls.

All fittings and materials used for the installation should be approved, suitable and installed properly for the intended application. For water tightness, the cord seal or conduit hub should be UL listed and marked 4X. The conduit hub is to be tightened onto the conduit before installing in the enclosure.

Where applicable, remove knockout(s) by impacting near the inside edge of the knockout to be removed. **IMPORTANT: Do not impact, dent or use the sensor for support. This will cause calibration and/or thermostat failure.**

WARNING

READ INSTRUCTION CAREFULLY BEFORE ATTEMPTING TO INSTALL, OPERATE OR SERVICE THIS THERMOSTAT. Failure to observe safety information and comply with instructions could result in PERSONAL INJURY, DEATH AND/OR PROPERTY DAMAGE. Retain these instructions for future reference. This product, when installed, will be part of an engineered system whose specifications and performance characteristics are not designed or controlled by PECO. You must review your application and national and local codes to assure that your installation will be functional and safe.

Even though this thermostat is sealed, water or dust could enter through improperly sealed wiring. A drip loop should be provided to prevent water and other liquids from entering the thermostat housing. The cord or conduit connections to the enclosure must be water and dust tight. The cover must be tightened securely to compress the gasket and provide a watertight seal. Use only screws provided. Do not over-tighten.

Maximum sensing element withstand temperature is 35°F (20°C) above the highest temperature setting. Maximum temperature for the plastic enclosure is 140°F 60°C.

CAUTION

For use in wet or humid environments or where water tightness is required, failure to use suitable watertight connections and suitable drip loop could allow water to enter the enclosure resulting in thermostat failure.

Use copper wire only. Insulate or wire-nut all unused leads.

Use the grounding provisions provided for connection to the line ground and equipment ground wire.

OPERATION AND CHECK-OUT

Allow one hour or necessary amount of time for the thermostat and system to stabilize for normal operation. This thermostat is factory calibrated and requires no correction on site.

TO CHECK OPERATION OF HEATING SYSTEMS:

1. Disconnect power.
2. Place the heat/cool selector switch, if applicable, in the heat position.
3. Adjust the thermostat set point to at least 10°F (5°C) below the temperature of the controlled space.
4. Restore power.
5. Slowly adjust the thermostat knob to raise the set point. When the set point reaches the approximate temperature of the controlled space, the heating equipment should start.

TO CHECK OPERATION OF COOLING SYSTEMS:

1. Disconnect power.
2. Place the heat/cool selector switch, if applicable, in the cool position.
3. Adjust the thermostat set point to at least 10°F (5°C) above the temperature of the controlled space.
4. Restore power.
5. Slowly adjust the thermostat knob to lower the set point. When the set point reaches the approximate temperature of the controlled space, the cooling equipment should start.

LIMITED WARRANTY

1. **WARRANTY COVERAGE.** PECO warrants to the original user of its products that the products will, at the date of initial purchase, meet the applicable specification for such products and will be free from any defects in materials or manufacture under normal use for 18 months after date of manufacture.
2. **DISCLAIMER OF WARRANTY OF PRODUCT SUITABILITY.** PECO makes no warranty to the purchaser or any third party that its products are suitable for a particular application or design. Many states and localities have differing codes or regulations governing the installation and/or use of PECO products. PECO cannot guarantee compliance with such regulations; purchaser is solely responsible for safe and correct installation and use of the product and for compliance with applicable codes and regulations.
3. **EXCLUSION OF IMPLIED WARRANTIES.** This warranty is the only warranty applicable to this product and excludes all other warranties, including any WARRANTY OF MERCHANTABILITY, any warranty of fitness for a particular purpose, and any implied warranties otherwise arising from course of dealing or usage of trade, except where the product purchased is subject to consumer product warranty laws, in which case ANY APPLICABLE IMPLIED WARRANTIES ARE LIMITED TO 18 MONTHS, or such shorter period as permitted or required under applicable law. Some States do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.
4. **REMEDIES FOR NONCONFORMITY.** If the product purchased does not conform to the applicable warranty, PECO will provide, at its option and in accordance with the procedures in the following section, one of the following remedies: (1) repair of the nonconforming product, (2) replacement with a conforming product, (3) refund of the original purchase price, THESE REMEDIES SHALL BE THE EXCLUSIVE AND SOLE REMEDY for any breach of warranty.
5. **TO OBTAIN WARRANTY SERVICE.** For any product believed to be defective within the limited warranty period, first write or call dealer from whom product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to PECO at the address below, giving dealer's name, address, date and number of dealer's invoice, and describe the nature of the defect.
6. **LIMITATION OF LIABILITY.** PECO WILL NOT BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES resulting from any defect in the product purchased. Some States do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from State to State.

Manufactured by PECO, Inc.
4709 SE 18th Avenue - Portland, OR 97202 - USA
P.O. Box 82189 - Portland, OR 97282 - USA

ADVERTENCIA

LEALAS INSTRUCCIONES CUIDADOSAMENTE ANTES DE TRATAR DE INSTALAR, OPERAR O HACER EL SERVICIO EN ESTE TERMOSTATO.

Si no se observa la información de seguridad y si no se siguen las instrucciones se pueden producir LESIONES PERSONALES, LA MUERTE Y/O DAÑO A LA PROPIEDAD. Guarde estas instrucciones para referencia en el futuro. Cuando este producto se instale, formará parte de un sistema de ingeniería cuyas especificaciones y características de rendimiento no han sido diseñadas ni son controladas por PECO. Es necesario que estudie su aplicación y los códigos locales y nacionales para asegurarse que su instalación funcionará bien y es segura.

APLICACION CORRECTA

Este termostato ha sido probado por CSA y por Underwriters Laboratories Inc. (UL), cumple con los requisitos del equipo NEMA 4X y es adecuado para usarse según el Artículo 547-4 del National Electrical Code (NEC), cuando se usa con los conectores impermeables correctos (no vienen incluidos).

INSTALACION

ADVERTENCIA

Para evitar el choque eléctrico o el daño en el equipo, desconecte toda la energía antes de instalarlo o de hacerle el servicio. Para evitar incendios potenciales y/o la explosión, no lo use en atmósferas potencialmente inflamables o explosivas.

Una persona calificada y capacitada en el servicio tiene que hacer la instalación, según el National Electrical Code (NEC) y según todos los códigos y regulaciones locales. La instalación tiene que cumplir con todos los códigos nacionales, estatales y locales aplicables. Refiérase al diagrama del cableado apropiado que viene incluido.

Ubique el termostato (modelos sensores locales) o la bombilla sensora (modelos sensores remotos) para lograr una percepción óptima de la temperatura del espacio controlado. La operación del termostato se verá afectada por el calor o el frío fuera de lo común, tal como la luz directa del sol, cerca de las ventanas o puertas o en las paredes exteriores.

Todos los accesorios y los materiales que se usan para la instalación tienen que ser aprobados, adecuados y ser instalados correctamente para la aplicación que se les va a dar. El sello del cordón o el cubo del conductor deben estar en la lista de UL y tienen que estar marcados 4X para lograr que sean impermeables. El cubo del conductor tiene que estar apretado en éste antes de instalarlo en la caja.

Cuando sea aplicable, remueva el(los) disco(s) removible(s) golpeando cerca del borde interior del disco removible que se removerá. **IMPORTANTE:** no golpee, ni abole, ni doble, ni use el sensor como soporte. Esto hará fallar la calibración y/o el termostato.

ADVERTENCIA

Para prevenir el sobrecalentamiento o los incendios, use este control solamente como un termostato de operación o regulador. SIEMPRE USE UN CONTROL DE REFUERZO O UNA ALARMA en los casos cuando el artefacto controlado se puede sobrecalentar o se puede producir un incendio si el control falla. Cuando el termostato puede pasar por el ciclo directamente entre las cargas de calefacción y las de enfriamiento, si no se proporciona un interruptor de transferencia de carga, el termostato puede fallar. No instale, ni use, ni opere el producto si parece dañado, si la caja está partida o rota o si el sensor se ha doblado, plegado o está sucio.

A pesar de que el termostato está sellado, el agua o el polvo podrían entrar a través del cableado mal sellado. Se tiene que proporcionar un ojal de goteo para impedir que el agua u otros líquidos entren en la caja del termostato. Las conexiones del cordón o del conductor que van a la caja tienen que ser impermeables y a prueba de polvo. La cubierta tiene que estar apretada en forma segura para comprimir la empaquetadura y proporcionar el sello impermeable. Use solamente los tornillos que vienen incluidos. No los apriete demasiado.

La temperatura máxima que puede soportar el elemento sensor es 20°C (35°F) sobre el ajuste de temperatura más alto. La temperatura máxima para la caja de plástico es 60°C (140°F).

PRECAUCION

Para usarlo en ambientes mojados o húmedos o en donde se necesita que sea impermeable, si no se usan las conexiones impermeables correctas y el ojal de goteo correcto, el agua podría entrar en la caja haciendo que el termostato falle. Use cables de cobre solamente, aisle o ponga tuercas de cables en todos los conductores que no están en uso. Use las estipulaciones para la conexión a tierra que vienen incluidas para la conexión a tierra de la línea y con el cable de conexión a tierra del equipo.

OPERACION Y REVISION

Permita una hora o el tiempo necesario para que el termostato y el sistema se establezcan para la operación normal. Este termostato ha sido calibrado en la fábrica y no necesita corregirse en el lugar en donde se va a usar.

COMO REVISAR LA OPERACION DE LOS SISTEMAS DE CALEFACCION:

1. Desconecte la energía.
2. Ponga el interruptor selector de calefacción/enfriamiento, si es aplicable, en la posición de calefacción.
3. Ajuste el punto de control del termostato a por lo menos 5°C (10°F) por debajo de la temperatura del espacio controlado.
4. Vuelva a conectar la energía.
5. Lentamente ajusté la manilla del termostato para elevar el punto de control. Cuando el punto de control alcance la temperatura aproximada del espacio controlado, el equipo de calefacción debería arrancar.

COMO REVISAR LA OPERACION DE LOS SISTEMAS DE ENFRIAMIENTO:

1. Desconecte la energía.
2. Ponga el interruptor de calefacción/enfriamiento, si es aplicable en la posición de enfriamiento.
3. Ajuste el punto de control del termostato a por lo menos 5°C (10°F) sobre la temperatura del espacio controlado.
4. Vuelva a conectar la energía.
5. Ajuste lentamente la manilla del termostato para bajar el punto de control. Cuando el punto de control alcance la temperatura aproximada del espacio controlado, el equipo de enfriamiento debería arrancar.

GARANTIA LIMITADA

1. COBERTURA DE LA GARANTIA. PECO le garantiza al usuario original de sus productos, que en la fecha de la compra inicial, cumplen con las especificaciones aplicables y no tendrán defectos ni en los materiales ni en la fabricación, si se someten al uso normal, por 18 meses después de la fecha de fabricación.

2. DECLINACION DE RESPONSABILIDAD DE LA GARANTIA POR LA ADAPTACION DEL PRODUCTO. PECO no le garantiza al comprador, ni a terceros, que sus productos se adaptan a una aplicación o diseño en particular. Muchos estados y jurisdicciones cuentan con códigos o regulaciones diferentes que gobiernan la instalación y/o el uso de los productos de PECO. PECO no puede garantizar que se cumplan dichas regulaciones; el comprador es el único responsable por la instalación segura y correcta, por el uso del producto y por el cumplimiento con los códigos y regulaciones aplicables.

3. EXCLUSION DE LAS GARANTIAS IMPLICITAS. Esta garantía es la única que se aplica a este producto y se excluyen todas las demás garantías. Incluyéndose toda GARANTIA DE COMERCIALIZACION, cualquier garantía de adecuación para un propósito en particular y cualquier garantía implícita que de alguna otra forma se presente en el curso de las transacciones o uso comercial, excepto en el caso cuando el producto comprado esté sujeto a las leyes de las garantías del producto, en cuyo caso TODA GARANTIA IMPLICITA APLICABLE QUEDA LIMITADA A 18 MESES, o a un período de tiempo más corto, según lo permita o lo exija la ley aplicable.

Algunos estados no permiten limitaciones en cuanto a la duración de las garantías implícitas, de modo que las limitaciones anteriores pueden que no se apliquen en su caso.

4. RECURSOS EN EL CASO DE DISCONFORMIDAD. Si el producto comprado no está de acuerdo con la garantía aplicada, PECO proporcionará, a su discreción, y según los procedimientos de la sección siguiente, uno de los recursos siguientes: (1) reparación del producto en disconformidad, (2) lo cambiará por uno conforme, (3) reembolsará el precio de compra original. ESTOS RECURSOS SERAN LOS UNICOS Y EXCLUSIVOS en el caso de cualquier violación de la garantía.

5. COMO OBTENER SERVICIO DEBIDO A LA GARANTIA. En el caso de que se crea que cualquier producto tenga defectos, dentro del período cubierto por la garantía limitada, primero escriba o llame al distribuidor a quien se le compró el producto. El distribuidor le dará las instrucciones adicionales. Si no se puede resolver la situación en forma satisfactoria, escriba a PECO a la dirección a continuación, dando el nombre y la dirección del distribuidor, la fecha y el número de la factura del distribuidor y describa la naturaleza del defecto.

6. LIMITACION DE RESPONSABILIDAD. PECO NO SERA RESPONSABLE POR DAÑOS CONCOMITANTES, ESPECIALES, INDIRECTOS O EMERGENTES que surjan por cualquier defecto del producto comprado. Algunos estados no permiten la exclusión o la limitación de los daños concomitantes o emergentes, de modo que la limitación o exclusión anteriores pueden que no se apliquen en su caso.

Esta garantía le otorga derechos legales específicos y puede que también tenga otros derechos que varían de Estado a Estado.

Fabricado por PECO, Inc.
4709 SE 18th Avenue - Portland, OR 97202 - USA
P.O. Box 82189 - Portland, OR 97282 - USA

AVERTISSEMENT

LIRE ATTENTIVEMENT LES INSTRUCTIONS AVANT DE COMMENCER À INSTALLER, UTILISER OU FAIRE LE SERVICE DE CE THERMOSTAT. Négliger d'observer les conseils de sécurité et d'appliquer les instructions peut être la cause de BLESSURES CORPORELLES, MORT ET/OU DOMMAGES MATÉRIELS. Conserver ces instructions pour références ultérieures. Quand il est installé, cet appareil fera partie d'un système industriel dont les spécifications et les caractéristiques de rendement ne sont pas conçues ou contrôlées par PECO. L'application et les codes nationaux et locaux doivent être revus pour assurer que l'installation sera fonctionnelle et sans danger.

APPLICATION APPROPRIÉE

Ce thermostat qui a été soumis aux tests de CSA et de Underwriters Laboratory, Inc. (UL) est en accord avec les conditions requises pour les équipements NEMA 4X et est acceptable pour usage sous les normes National Electrical Code (NEC), Article 547-4, quand utilisé avec les connecteurs étanches appropriés (pas inclus).

INSTALLATION

AVERTISSEMENT

Pour éviter les chocs électriques ou les dommages matériels, débrancher l'alimentation électrique avant d'installer ou de faire le service. Pour éviter un incendie et/ou une explosion possible, ne pas utiliser dans un environnement potentiellement inflammable ou explosif.

L'installation doit être faite par un technicien de service qualifié et être en accord avec le National Electrical Code (NEC) et tous les codes nationaux et locaux applicables. Se reporter au diagramme de câblage approprié inclus.

Situer le thermostat (modèles à détection sur place) ou la sonde (modèles à détection éloignée) pour obtenir une détection optimum de la température de l'espace contrôlé. Le fonctionnement du thermostat est affecté par une chaleur ou un froid inhabituel, tel que l'exposition directe au soleil, près d'une fenêtre, un porte ou un mur extérieur.

Tous les raccords et matériaux utilisés pour l'installation doivent être approuvés, adaptés et correctement installés en fonction de l'application prévue. Pour l'étanchéité, le joint du câble ou raccord de conduit doit être classé UL et être marqué 4X. Le raccord de conduit doit être fixé sur le conduit avant de l'installer dans le boîtier.

Si applicable, les parties éjectables doivent être retirées par impact près du bord intérieur de la partie éjectable qui doit être retirée. IMPORTANT: NE PAS TAPER, ÉBRÉCHER, TORDRE OU UTILISER LA SONDE COMME SUPPORT. CECI CAUSERAIT LA DÉFAILLANCE DU CALIBRAGE ET/OU DU THERMOSTAT. SONDE COMME SUPPORT. CECI CAUSERAIT LA DÉFAILLANCE DU CALIBRAGE ET/OU DU THERMOSTAT.

AVERTISSEMENT

Pour éviter la surchauffe ou le feu, utiliser ce contrôle uniquement comme un thermostat de fonctionnement ou de réglage. TOUJOURS UTILISER UN CONTRÔLE OU UNE ALARME DE REDONDANCE si une défaillance du contrôle pourrait causer la surchauffe de l'appareil contrôlé ou pourrait causer un incendie. Si le thermostat est capable d'entrer en cycle directement entre des charges de chauffage et de refroidissement, négliger d'installer un commutateur de transfert de charge résultera en défaillance du thermostat. Ne pas installer, utiliser ou faire fonctionner si l'appareil semble endommagé, si le boîtier est fendu ou cassé, ou si la sonde a été tordue, pilée ou est sale.

Bien que ce thermostat soit scellé, l'eau ou la poussière peuvent y entrer par un câblage mal étanchéifié. Une boucle d'égouttage doit être prévue pour empêcher l'eau ou tout autre liquide d'entrer dans le boîtier du thermostat. La connexion de câble ou de conduit avec le boîtier doit être hermétique à l'eau et à la poussière. Le couvercle doit être solidement fixé pour compresser le joint et créer l'étanchéité. Utiliser uniquement les vis fournies. Ne pas surser. L'élément de sonde maximum peut supporter une température de 20°C (35°F) au-dessus du réglage de la plus haute température. La température maximum pour le boîtier plastique est de 60°C (140°F).

ATTENTION

Pour usage dans un environnement mouillé ou humide ou si l'étanchéité est requise, négliger d'utiliser des connexions adaptées pour l'étanchéité et une boucle d'égouttage appropriée pourrait permettre la pénétration d'eau dans le boîtier et causer la défaillance du thermostat.

Utiliser uniquement des fils de cuivre, isoler ou placer sous cônes d'isolation tous les conducteurs inutilisés. Utiliser les bornes de mise à la terre prévues pour connexion sur la ligne de prise de terre et le fil de terre de l'équipement.

FONCTIONNEMENT ET VÉRIFICATION

Attendre une heure ou la période de temps nécessaire pour que le système et le thermostat se stabilisent sur un fonctionnement normal. Ce thermostat a été calibré à l'usine et il ne nécessite aucun ajustement sur place.

POUR VÉRIFIER LE FONCTIONNEMENT DES SYSTÈMES DE CHAUFFAGE:

1. Débrancher l'alimentation électrique
2. Si applicable, place le sélecteur chaud/froid sur la position "chaud".
3. Ajuster le réglage du thermostat sur un point au moins 5°C (10°F) au-dessous de la température de l'espace contrôlé.
4. Rebrancher l'alimentation électrique.
5. Ajuster lentement la molette du thermostat pour monter le point de réglage. Quand le point de réglage atteint la température approximative de l'espace contrôlé, l'équipement de chauffage doit se mettre en marche.

POUR VÉRIFIER LE FONCTIONNEMENT DES SYSTÈMES DE REFOUILLISSEMENT:

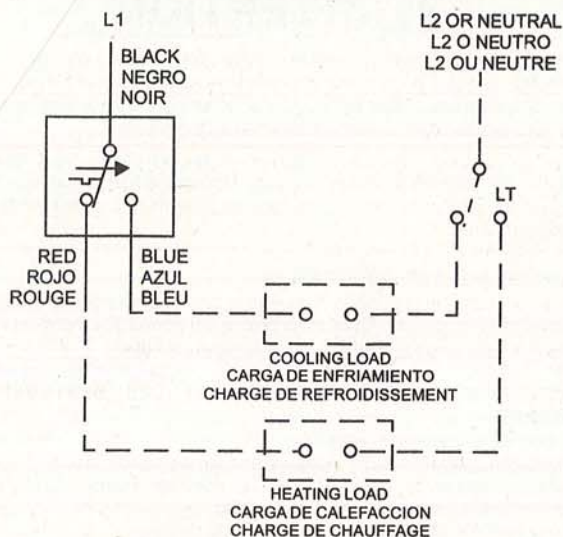
1. Débrancher l'alimentation électrique.
2. Si applicable, placer le sélecteur chaud/froid sur la position "froid".
3. Ajuster le réglage du thermostat sur un point au moins 5°C (10°F) au-dessous de la température de l'espace contrôlé.
4. Rebrancher l'alimentation électrique.
5. Ajuster lentement la molette du thermostat pour descendre le point de réglage. Quand le point de réglage atteint la température approximative de l'espace contrôlé, l'équipement de climatisation doit se mettre en marche.

GARANTIE LIMITÉE

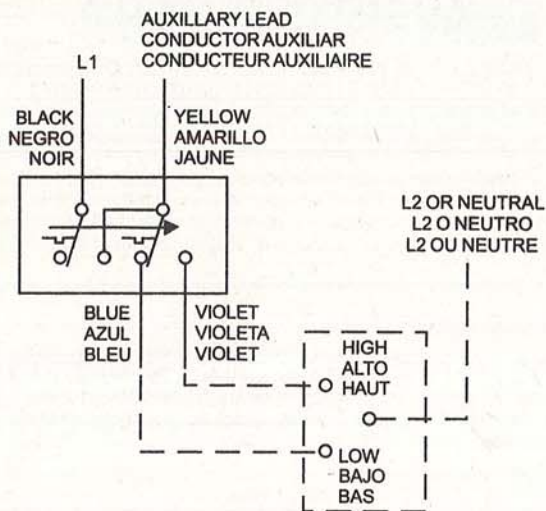
1. COUVERTURE GARANTIE. PECO garantit au premier utilisateur de ses produits, que les produits sont, à la date de l'achat initial, en accord avec les spécifications applicables pour ces productions et seront, sous usage normal, sans défauts de matières premières ou de main d'œuvre pendant 18 mois à partir de la date de fabrication.
2. DÉSIÈTÈMENT DE GARANTIE D'APTITUDE DU PRODUIT. PECO ne donne aucune garantie à l'acheteur ou à toute autre tierce personne concernant l'adaptabilité de ses produits pour une application ou une conception particulière. De nombreuses juridictions ont des codes différents ou des règlements gouvernant l'installation et/ou l'usage des produits de PECO. PECO ne peut pas garantir l'observance de ces règlements, l'acheteur est seul responsable de l'installation et de l'usage correct et sans danger de ce produit ainsi que de l'observance des codes et règlements applicables.
3. EXCLUSION DE GARANTIES IMPLIQUÉES. Cette garantie est la seule applicable à ce produit, et elle exclut toutes autres garanties, compris toute GARANTIE DE COMMERCIALISATION, toute garantie d'adaptabilité à un usage particulier, et toutes garanties impliquées au cours de transactions commerciales, sauf là où le produit acheté est soumis aux lois de garantie de produit aux consommateurs, dans tous les cas TOUTES GARANTIES IMPLIQUÉES APPLICABLES SONT LIMITÉES À 18 MOIS, ou à une période Plus courte si permise ou requise par la loi applicable. Certaines juridictions ne permettent de limitations de la durée de la garantie, donc les limitations ci-dessus peuvent ne pas s'appliquer dans le cas présent.
4. REMÈDES CONTRE L'ANON-CONFORMITÉ. Si le produit acheté n'est pas conforme à la garantie applicable, PECO fournira, à son choix et en accord avec le processus de la section suivante, l'un des remèdes suivants: (1) réparation du produit non-conforme. (2) remplacement par un produit conforme. (3) remboursement du prix d'achat d'origine. CES REMÈDES SERONT LES REMÈDES SEULS ET EXCLUSIFS pour toute infraction à la garantie.
5. POUR OBTENIR LE SERVICE SOUS GARANTIE. Pour tout produit considéré défectueux au cours de la période couverte par la garantie, commencer par écrire ou appeler le concessionnaire chez qui le produit a été acheté. Le concessionnaire doit donner des directions additionnelles. Si un accord satisfaisant ne peut pas être obtenu, écrire à PECO à l'adresse ci-dessous, en donnant le nom et l'adresse du concessionnaire, la date et le numéro de la facture du concessionnaire et en décrivant la nature du défaut.
6. LIMITATION DE RESPONSABILITÉ. PECO NE SERA PAS RESPONSABLE DE TOUTS DOMMAGES IMPRÉVUS, SPÉCIAUX, INDIRECTS OU FORTUITS résultant d'un produit acheté défectueux. Certaines juridictions ne permettent pas l'exclusion ou la limitation des dommages indirects ou fortuits, donc la limitation ou exclusion ci-dessus peut ne pas s'appliquer dans le cas présent.

Cette garantie donne des droits légaux spécifiques, et il peut y avoir d'autres droits variants de juridiction à juridiction.

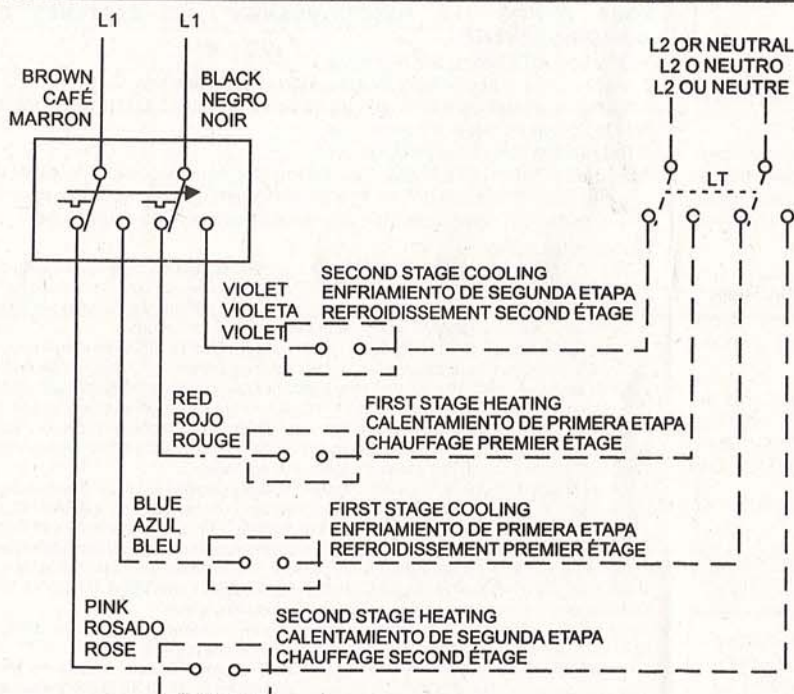
Fabrique par PECO, Inc.
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T115 TA119 TC109 TC119



TJ109 MODELS



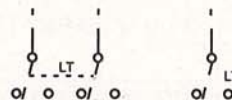
TH109

**LEGEND
LEYENDA
LÉGENDE**

THERMOSTAT WIRING
CABLEADO DEL TERMOSTATO
CABLAGE DU THERMOSTAT

FIELD WIRING
CABLEADO EN EL TERRENO
CABLAGE SUR PLACE

INDICATES SEQUENCE ON
TEMPERATURE RISE
INDICA LA SECUENCIA CUANDO LA
TEMPERATURA SE
INDIQUE LA SE SÉQUENCE DE LA MONTÉE
DE TEMPÉRATURE



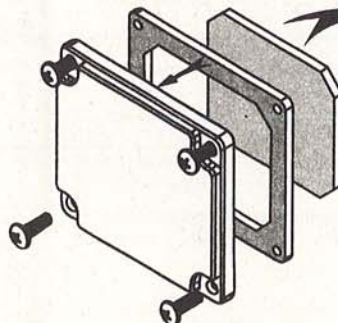
LOAD TRANSFER SWITCH
INTERRUPTOR DE TRANSFERENCIA DE CARGA
INTERRUPTEUR DE TRANSFERT DE CHARGE

**WARNING
ADVERTENCIA
AVERTISSEMENT**

-TO INSURE WATER TIGHTNESS, THE ENCLOSED GASKET MUST BE INSTALLED UNDER THE WIRING CAP.

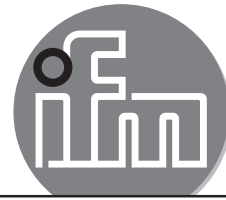
-PARA ASEGURAR LA ESTANQUIDAD AL AGUA, LA JUNTA SUMINISTRADA DEBERÁ INSTALARSE DEBAJO DEL CASQUETE DEL ALAMBRADO.

-POUR ASSURER L'ÉTANCHÉITÉ À L'EAU, LE JOINT STATIQUE (FOURNI) DOIT ÊTRE INSTALLÉ SOUS LE CULOT POUR CÂBLAGE.



-REMOVE AND DISCARD
THE CENTER OF THE GASKET
-EXTRAIGA Y DESCARTE
LA PARTE CENTRAL DE LA JUNTA
-ENLEVER LE CENTRE DU
JOINT ET LE METTRE AU REBUT

ifm electronic



VT-701/ 702 - Transmitter, Pressure/ Vacuum, IFM efector, PG2409 Scale -14.5- 14.5 PSI 4-20mA



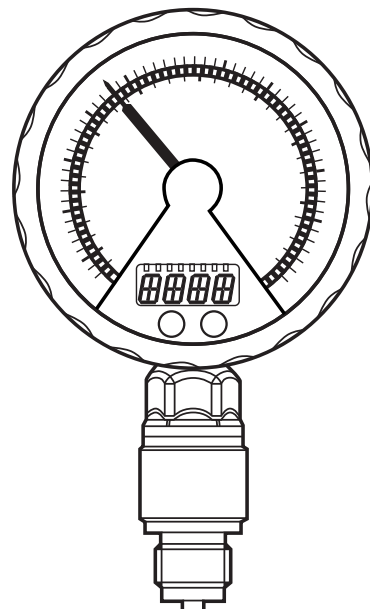
Operating instructions
Electronic manometer

efector500®

PG24xx

UK

706086/00 08/2011



E-1375

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1 Preliminary note

1.1 Symbols used

- Instruction
- > Reaction, result
- [...] Designation of pushbuttons, buttons or indications
- Cross-reference
-  Important note
Non-compliance can result in malfunctions or interference.
-  Information
Supplementary note.

2 Safety instructions

- Please read this document prior to set-up of the unit. Ensure that the product is suitable for your application without any restrictions.
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property can occur.
- Check the compatibility of the product materials (→ 12 Technical data) with the media to be measured in all applications.
- Use in gases at pressures > 25 bar only after contacting the manufacturer ifm.

- High-pressure units (250 bar, 400 bar) are supplied with an integrated damping device to comply with the regulations for UL approval and to avoid any risk of injury in case of bursting when bursting pressure is exceeded.



Any manipulation of the damping device is not permissible.

When the damping device is removed, there is no damping function any more. ATTENTION: risk of injury!

For units with cULus approval this approval becomes invalid when the damping device is removed.

For the scope of validity cULus:

The Sensor shall be connected only by using any R/C (CYJV2) cord, having suitable ratings.

The device shall be supplied from an isolating transformer having a secondary Listed fuse rated either

a) max 5 amps for voltages 0~20 Vrms (0~28.3 Vp) or

b) 100/Vp for voltages of 20~30 Vrms (28.3~42.4 Vp).

3 Functions and features

The unit monitors the system pressure in a plant.

3.1 Applications

Type of pressure: relative pressure

Order no.	Measuring range (in brackets: extended display range)		Permissible overpressure		Bursting pressure	
	bar	PSI	bar	PSI	bar	PSI
PG2409	-1...1 (1.6)	-14.52...14.52 (23.22)	10	145	30	435
PG2450	0...400 (600)	0...5800 (8700)	800	11600	1200	17400
PG2451	0...250 (400)	0...3625 (5800)	600	8700	1000	14500
PG2452	0...100 (160)	0...1449 (2322)	300	4350	700	9400
PG2453	-1...25 (40)	-14.5...362.5 (580.0)	100	1450	350	5070
PG2454	-1...10 (16)	-14.4...145 (232)	50	725	150	2175
PG2455	-1...4 (6.4)	-14.5...58 (92.8)	30	435	100	1450
PG2456	-0.125...2.5 (4)	-1.8...36.25 (58.00)	20	290	50	725
PG2457	-0.05...1 (1.6)	-0.72...14.5 (23.20)	10	145	30	435

Order no.	Measuring range (in brackets: extended display range)		Permissible overpressure		Bursting pressure	
	mbar	inH2O	bar	inH2O	bar	inH2O
PG2458	-12.5...250 (400)	-5.0..100.4 (160.6)	10	4015	30	12044
PG2489	-5...100 (160)	-2.00...40.16 (64.24)	4	1606	30	12044



Avoid static and dynamic overpressure exceeding the given overload pressure by taking appropriate measures.

The indicated bursting pressure must not be exceeded.

Even if the bursting pressure is exceeded only for a short time, the unit may be destroyed. ATTENTION: risk of injury!

Use in gases at pressures > 25 bar only after contacting the manufacturer ifm.

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4 Function

4.1 Processing of the measured signals

- The unit generates 2 output signals according to the parameter settings.

OUT1	• Switching signal for system pressure limit value.
OUT2	• Analogue signal (4...20 mA, 20...4 mA).

- The unit displays the current system pressure.

Analogue display: circular scale with pointer.
Digital display (alphanumeric display, 4 digits).

- In addition, an LED ring with one of the following display options is available:

Display of set point and reset point.
Trend display (rising pressure / falling pressure).
Lag indicator function for maximum value or minimum value.
Display of pulsating signals and pressure peaks.

4.2 Pressure monitoring / switching function

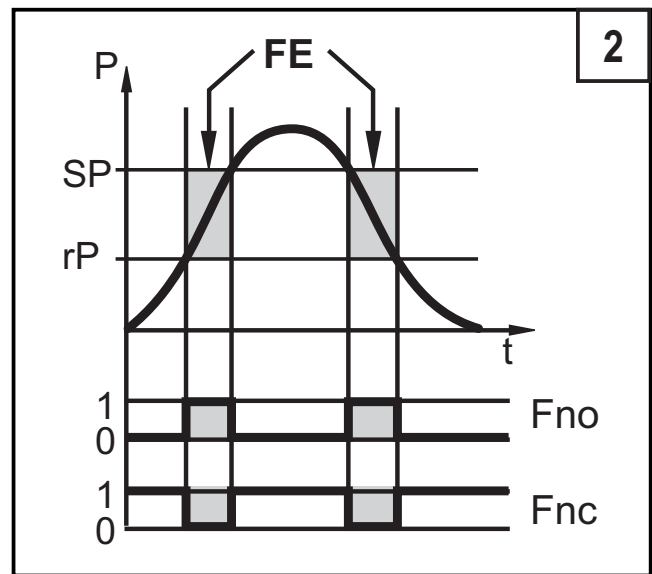
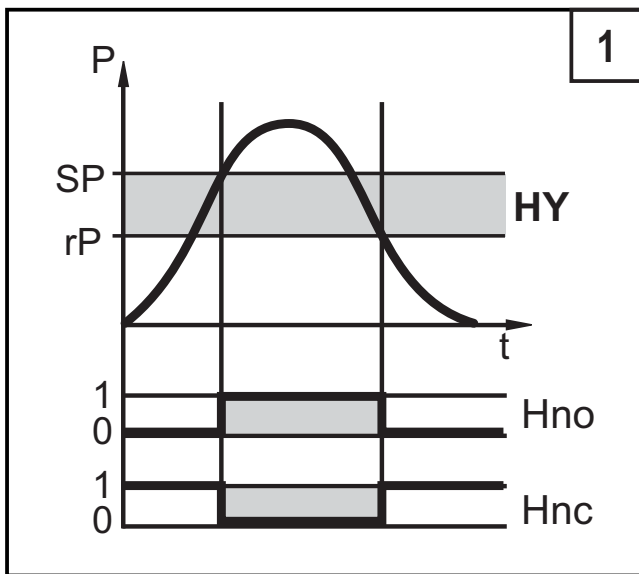
OUT1 changes its switching state if it is above or below the set switching limits (SP1, rP1). The following switching functions can be selected:

- Hysteresis function / normally open: [OU1] = [Hno] (→ fig. 1).
- Hysteresis function / normally closed: [OU1] = [Hnc] (→ fig. 1).

First the set point (SP1) is set, then the reset point (rP1) with the requested difference.

- Window function / normally open: [OU1] = [Fno] (→ fig. 2).
- Window function / normally closed: [OU1] = [Fnc] (→ fig. 2).

The width of the window can be set by means of the difference between SP1 and rP1. SP1 = upper value, rP1 = lower value.



P = system pressure; HY = hysteresis; FE = window

4.3 Pressure monitoring / analogue function

The analogue output can be configured.

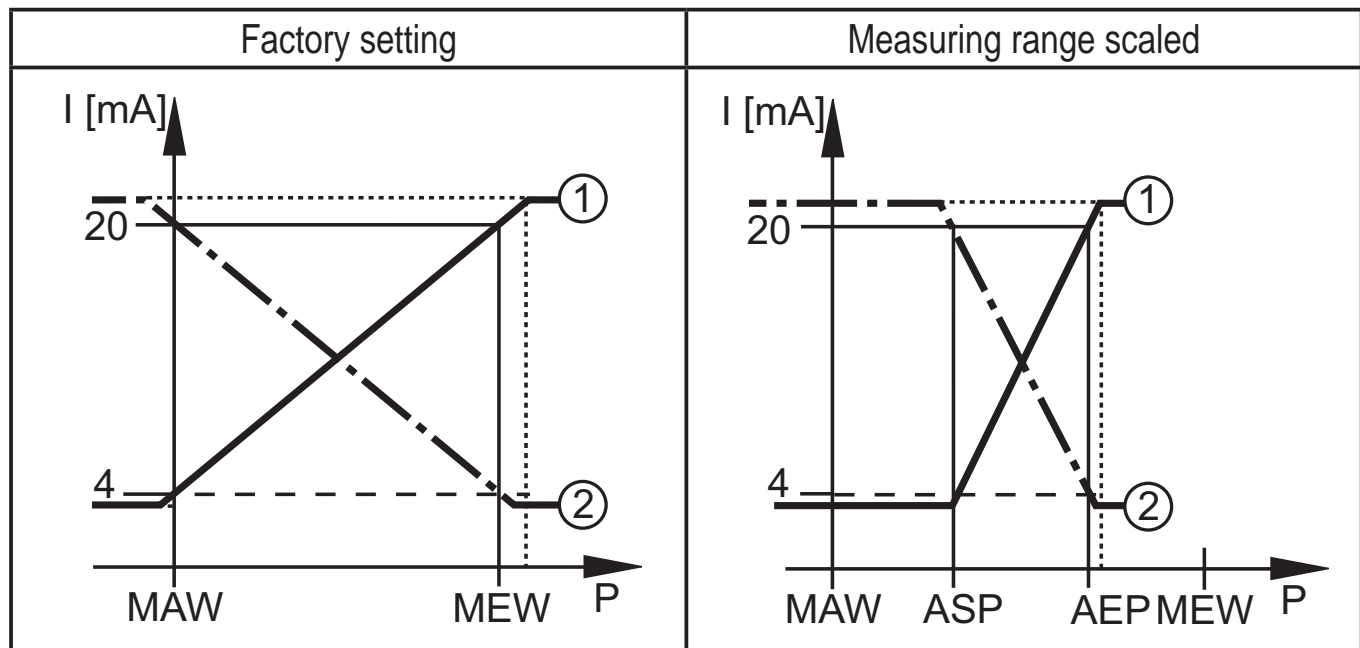
- [OU2] defines whether the set measuring range is provided as 4...20 mA ([OU2] = [I]) or as 20...4 mA ([OU2] = [InEG]).

Scaling can be set by means of the teaching process or by entering a value for the ASP and AEP parameters.

- Teaching the analogue start point [tASP] or setting the parameter [ASP] defines at which measured value the analogue signal is 4 mA (20 mA at [InEG]).
- Teaching the analogue end point [tAEP] or setting the parameter [AEP] defines at which measured value the output signal is 20 mA (4 mA at [InEG]).

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Minimum distance between [ASP] and [AEP] = 25 % of the final value of the measuring range.



P = system pressure , MAW = initial value of the measuring range, MEW = final value of the measuring range

①: [OU2] = [I]; ②: [OU2] = [InEG]

In the set measuring range the output signal is between 4 and 20 mA ([OU2] = [I]) or between 20 and 4 mA ([OU2] = [InEG]).

It is also indicated:

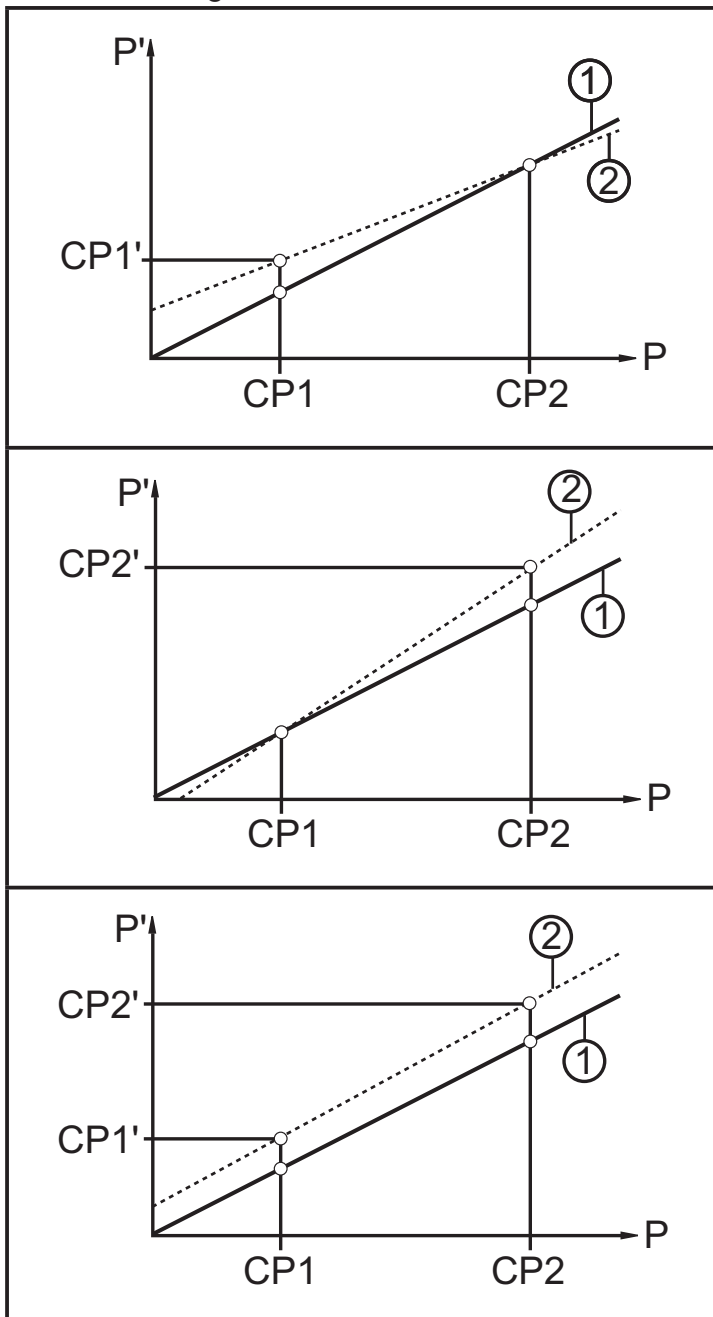
- System pressure above the measuring range:
 - Output signal 20 to 20.5 mA at [OU2] = [I].
 - Output signal 4 to 3.8 mA at [OU2] = [InEG].
- System pressure below the measuring range:
 - Output signal 4 to 3.8 mA at [OU2] = [I].
 - Output signal 20 to 20.5 mA at [OU2] = [InEG].

4.4 Customer-specific calibration

The customer-specific calibration changes the curve of measured values compared to the real measured values (shifting / change of the gradient; → 9.4.6 [CAL]).

- Two calibration points can be defined (CP1, CP2). The two points are independent of each other. They must be within the measuring range and not in the extended display range.
- The zero point calibration [COF] influences the calibration of the curve of measured values. Recommendation: set [COF] to 0 (→ 9.4.1 [COF]), then calibrate the curve of measured values.

After a change the calibration can be reset to factory setting (→ 9.5.2 [rES]).



- P = measured pressure;
 P' = modified measured value
- CP1 = calibration point 1;
CP1' = modified measured value for CP1
- CP2 = calibration point 2;
CP2' = modified measured value for CP2
- 1 = curve of measured values at factory setting
- 2 = curve of measured values after calibration

5 Installation



Before installing and removing the unit: make sure that no pressure is applied to the system. Note: If 0% is displayed and no pointer is visible, this does not mean that no pressure is applied to the system !

We recommend horizontal installation for high medium temperatures.

The unit can be fixed to different process connections. Options are as follows:

1	Installation with seals to DIN EN 837-1 <ul style="list-style-type: none"> ▶ Insert the unit and the seal into the process connection with cylindrical pipe thread G$\frac{1}{2}$ and tighten. <p>All seals to DIN EN 837-1 can be used if they are suitable for process connections with cylindrical pipe thread, e.g. flat seals or double-edge sealing rings.</p>
2	Installation with sealing tape <ul style="list-style-type: none"> ▶ Insert the unit and the sealing tape into the process connection with G$\frac{1}{2}$ internal thread (e.g. welding adapter) and tighten.
3	Installation at flange G$\frac{1}{2}$ (based on DIN 3852-11) <p>The sealing ring on the sensor is used as process seal. The upper sealing area on the process connection must be flush with the tapped hole and have a surface characteristic of min. Rz 6.3.</p> <ul style="list-style-type: none"> ▶ Grease the sensor thread with a suitable paste. ▶ Insert the unit into the process connection. ▶ Tighten it using a spanner. Tightening torque: 35 Nm.

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After installation the analogue display can be rotated / adapted to the installation position (to do so wear protective gloves).

6 Electrical connection

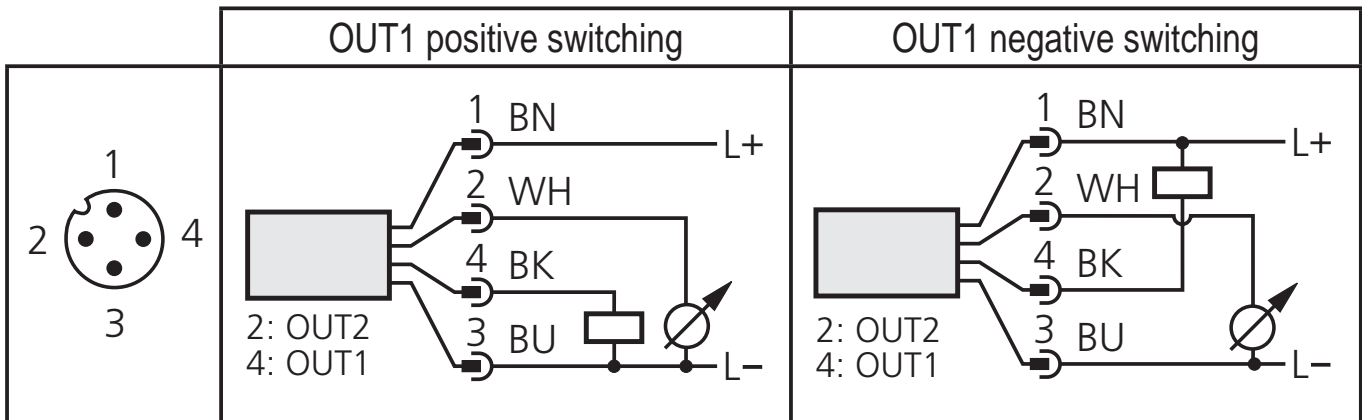


The unit must be connected by a qualified electrician.

The national and international regulations for the installation of electrical equipment must be adhered to.

Voltage supply according to EN 50178, SELV, PELV.

- Disconnect power.
- Connect the unit as follows:

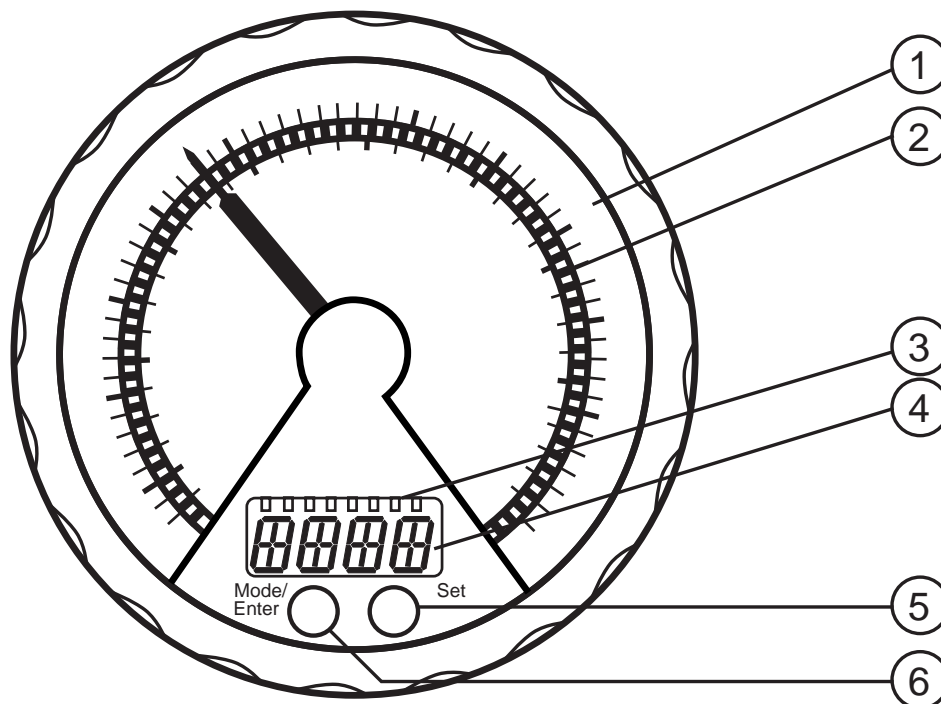


Pin 1	Ub+
Pin 3	Ub-
Pin 4 (OUT1)	• Binary switching output pressure monitoring
Pin 2 (OUT2)	• Analogue output for system pressure

Core colours of ifm sockets:

1 = BN (brown), 2 = WH (white), 3 = BU (blue), 4 = BK (black)

7 Operating and display elements



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1: Analogue display

- Display of the current system pressure in bar and PSI or mbar and inH2O.

2: LED ring

According to the setting of parameter [LED] (→ 9.2):

- Display of set point and reset point.
- Lag indicator function for maximum value or minimum value.
- Display of pulsating signals and pressure peaks.
- Trend display: rising pressure or falling pressure.

3: Indicator LEDs

- LED 1 = system pressure of the digital display in bar.
- LED 2 = system pressure of the digital display in mbar.
- LED 3 = system pressure of the digital display in PSI.
- LED 4 = system pressure of the digital display in inH2O.
- LED 6 = system pressure in % of the scaling (range ASP to AEP) or COF value in %.
- LEDs 5, 7 = not used.
- LED 8 = switching status OUT1 (lights if output 1 is switched)

4: Alphanumeric display, 4 digits

- Display of the current system pressure.
- Display of the parameters and parameter values.

5: Touch button Set*

- Setting of the parameter values (continuously by touching permanently; step by step by touching briefly several times).

6: Touch button Mode/Enter*

- Selection of the parameters and acknowledgement of the parameter values.

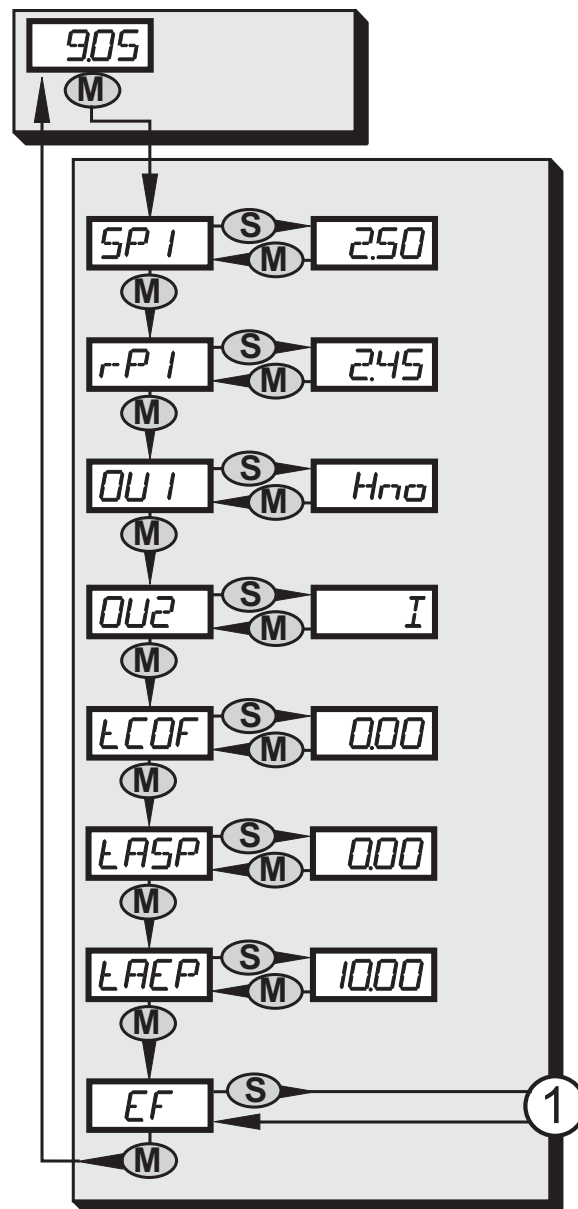
* The two touch buttons are activated simply by touching / deactivated by releasing the touch button.

The touch button must be completely covered to be activated.

Slow covering (e.g. liquid flows over the display) does not activate the touch button.

8 Menu

8.1 Menu structure: main menu



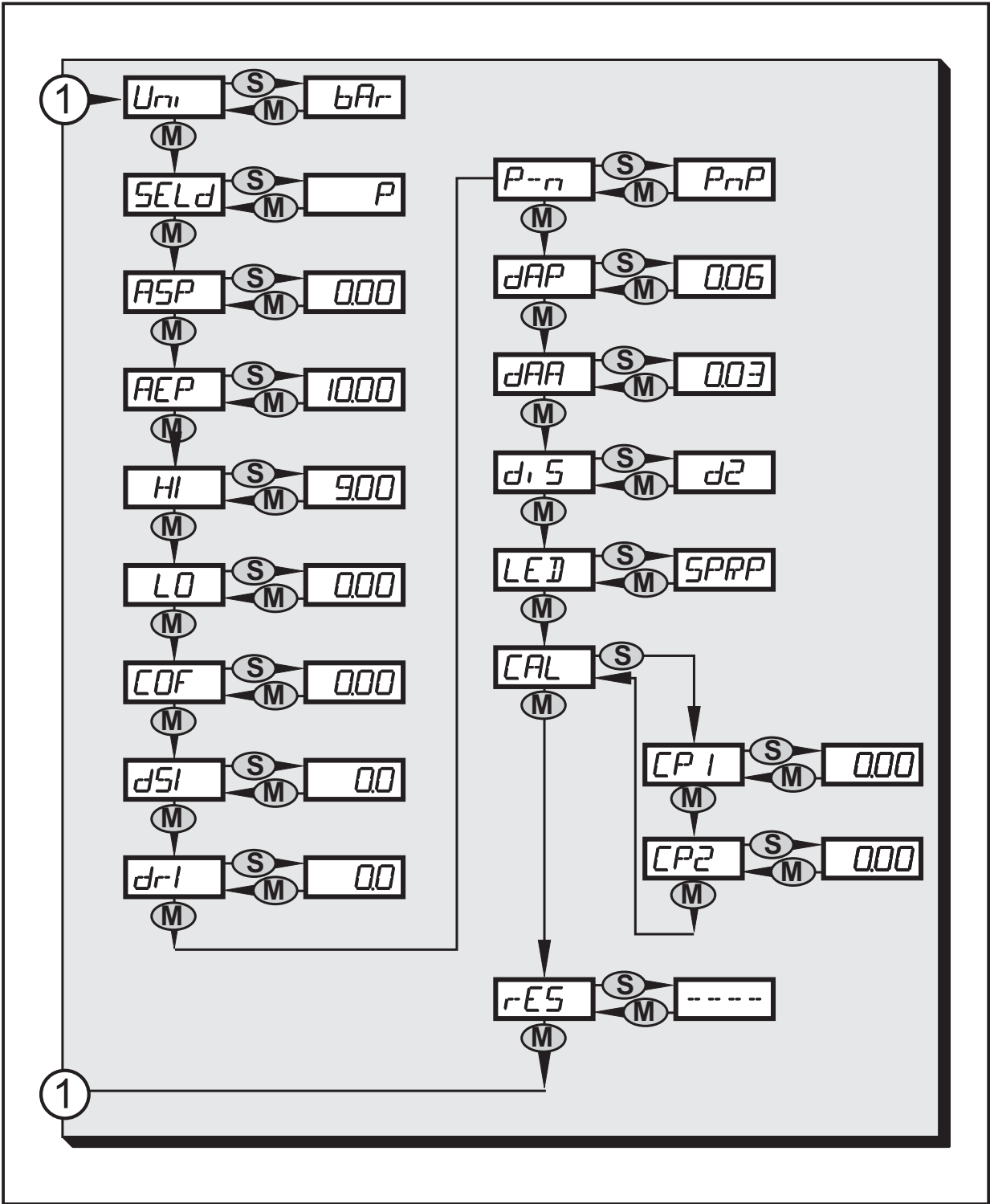
1: Change to menu level 2 (extended functions)

8.2 Explanation of the main menu

SP1/rP1	Upper / lower limit value for system pressure at which OUT1 switches.
OU1	Output function for OUT1: • Switching signal for the pressure limit values: hysteresis function [H ..] or window function [F ..], either normally open [. no] or normally closed [. nc].
OU2	Output function for OUT2: • Analogue signal for the current system pressure: 4...20 mA [I], 20...4 mA [InEG].
tCOF	Teach zero-point calibration.
tASP	Teach analogue start point for system pressure: set measured value at which 4 mA is provided (20 mA if [OU2] = [InEG]).
tAEP	Teach analogue end point for system pressure: set measured value at which 20 mA is provided (4 mA if [OU2] = [InEG]).
EF	Extended functions / opening of menu level 2.

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8.3 Menu structure: level 2 (extended functions)



1: Change to the main menu

8.4 Explanation of the menu level 2

Uni	Standard unit of measurement for system pressure (bar or PSI).
SELd	Display mode: <ul style="list-style-type: none"> • Pressure in the unit set in [Uni]. • Pressure in % of the set scaling of the analogue output.
ASP	Analogue start point for system pressure: measured value at which 4 mA is provided (20 mA if [OU2] = [InEG]).
AEP	Analogue end point for system pressure: measured value at which 20 mA is provided (4 mA if [OU2] = [InEG]).
HI	Maximum value memory for system pressure.
LO	Minimum value memory for system pressure.
COF	Zero-point calibration.
dS1	Switch-on delay for OUT1.
dr1	Switch-off delay for OUT1.
P-n	Switching logic for OUT1: pnp or npn.
dAP	Damping for switching outputs and display.
dAA	Damping for analogue output (OUT2).
diS	Update rate and orientation of the display.
LED	Setting for the LED ring.
CAL	Calibration function (setting the curve of measured values).
CP1	Calibration point 1
CP2	Calibration point 2
rES	Restore factory settings.

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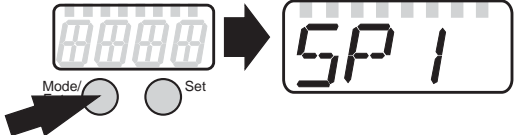
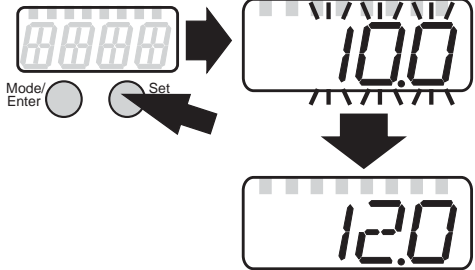
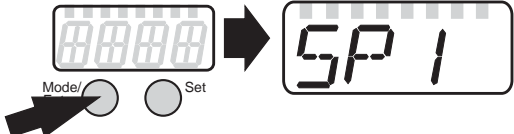
9 Parameter setting

During parameter setting the unit remains in the operating mode. It continues its monitoring function with the existing parameters until the parameter setting has been completed.

Exceptions: changes to the parameters COF (→ 9.4.1), CP1 and CP2 (→ 9.4.6) take effect immediately.

9.1 General parameter setting

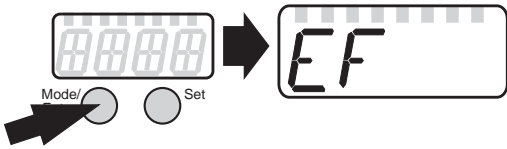
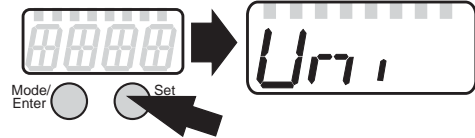
3 steps must be taken for each parameter setting:

1	Select parameter <ul style="list-style-type: none"> ▶ Touch [Mode/Enter] until the requested parameter is displayed. 	
2	Set parameter value <ul style="list-style-type: none"> ▶ Touch [Set] and keep it touched. > Current setting value of the parameter flashes for 5 s. > After 5 s: setting value is changed: step by step by touching briefly several times or continuously by touching permanently. 	
	Numerical values are incremented continuously. To reduce the value: let the display move to the maximum setting value. Then the cycle starts again at the minimum setting value.	
3	Acknowledge parameter value <ul style="list-style-type: none"> ▶ Touch [Mode/Enter] briefly. > The parameter is displayed again. The new setting value is saved. 	
Set other parameters <ul style="list-style-type: none"> ▶ Start again with step 1. 		
Finish parameter setting <ul style="list-style-type: none"> ▶ Touch [Mode/Enter] several times until the current measured value is displayed or wait for 15 s. > The unit returns to the operating mode. 		

- Timeout:

If no touch button is activated for 15 s during parameter setting, the unit returns to the operating mode with unchanged values.

- Change from menu level 1 to menu level 2:

<ul style="list-style-type: none"> ▶ Touch [Mode/Enter] until [EF] is displayed. 	
<ul style="list-style-type: none"> ▶ Touch [Set] briefly. > The first parameter of the submenu is displayed (here: [Uni]). <p>If the menu level 2 is protected by an access code, "Cod1" flashes in the display.</p> <ul style="list-style-type: none"> ▶ Touch [Set] and keep it touched until the valid code no. appears. ▶ Touch [Mode/Enter] briefly. <p>On delivery by ifm electronic: no access restriction.</p>	

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- Locking / unlocking

The unit can be locked electronically to prevent an unintentional operation.

<ul style="list-style-type: none"> ▶ Make sure that the unit is in the normal operating mode. ▶ Touch [Set], ▶ additionally touch [Mode/Enter] and keep both buttons touched for 10 s. > The LED for the current unit of measurement flashes, the current system pressure continues to be displayed. After 10 s the display goes out for approx. 1 s. ▶ Release [Mode/Enter] and [Set] again. Both buttons must be released within 4 s. If this does not happen, the unit remains unlocked. > [Loc] is displayed, the unit is locked. . <p>During operation the indicator LED for the display unit (→ chapter 7) is flashing if you try to open the menu.</p>	<p>For unlocking:</p> <ul style="list-style-type: none"> ▶ Make sure that the unit is in the normal operating mode. ▶ Touch [Set], ▶ additionally touch [Mode/Enter] and keep both buttons touched for 10 s. > The LED for the current unit of measurement flashes, the current system pressure continues to be displayed. After 10 s the display goes out for approx. 1 s. ▶ Release [Mode/Enter] and [Set] again. Both buttons must be released within 4 s. If this does not happen, the unit remains unlocked. > [uLoc] is displayed, the unit is unlocked.
---	--

On delivery: unlocked.

9.2 Configuration of the digital display (optional)

<p>► Select [Uni] and set the unit of measurement:</p> <ul style="list-style-type: none"> - [bAr] / [mbAr]. - [PSI] / [inHO]. 	
<p>► Select [SEld] and set type of indication:</p> <ul style="list-style-type: none"> - [P]: system pressure in the unit set in Uni. - [P%]: system pressure in % of the set scaling of the analogue output; the following applies: 0 % = ASP value / 100 % = AEP value. <p>Note: display "0 %" does not mean that no pressure is applied to the system.</p>	
<p>► Select [diS] and set the update rate of the display:</p> <ul style="list-style-type: none"> - [d1]: update of the measured values every 50 ms. - [d2]: update of the measured values every 200 ms. - [d3]: update of the measured values every 600 ms. - [OFF] = The measured value display is deactivated in the Run mode. Touching one of the buttons indicates the current measured value for 15 s. Touching the [Mode/Enter] button again activates the display mode. The indicator LEDs remain active even if the display is deactivated. 	
<p>► Select [LED] and set the display function for the digital display and LED ring:</p> <ul style="list-style-type: none"> - [SPRP]: One LED on the LED ring indicates the set point and a second LED the reset point. - [HInd]: 2 adjacent LEDs on the LED ring mark the lag indicator for maximum value ([HInd], high indication). - [LInd]: 2 adjacent LEDs on the LED ring mark the lag indicator for minimum value ([LInd], low indication). <p>To reset:</p> <ul style="list-style-type: none"> ► Touch [Set] for 1 second. > The two LEDs jump to the current position of the pointer. <ul style="list-style-type: none"> - [Ph]: Display of pulsating signals and pressure peaks: <ul style="list-style-type: none"> - In case of quick pressure changes (quickly pulsating signals) the digital display and LED ring indicate the minimum value and the maximum value. - In case of one-time short pressure peaks the digital display and LED ring show the indication for a longer time. - [Pdir]: The LED ring indicates the trend of the pressure changes (5 LEDs below the pointer for rising pressure; 5 LEDs above the pointer for falling pressure). <p>A damping set with dAP or dAA also has an effect on this display.</p>	

9.3 Set output signals

9.3.1 Set output functions

<ul style="list-style-type: none"> ▶ Select [OU1] and set the switching function: <ul style="list-style-type: none"> - [Hno] = hysteresis function/NO. - [Hnc] = hysteresis function/NC. - [Fno] = window function/NO. - [Fnc] = window function/NC. 	<i>OU 1</i>
<ul style="list-style-type: none"> ▶ Select [OU2] and set the analogue function: <ul style="list-style-type: none"> - [I] = current signal proportional to pressure 4...20 mA. - [InEG] = current signal proportional to pressure 20...4 mA. 	<i>OU2</i>

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9.3.2 Set switching limits

<ul style="list-style-type: none"> ▶ Select [SP1] and set the value at which the output switches. 	<i>SP 1</i>
<ul style="list-style-type: none"> ▶ Select [rP1] and set the value at which OUT1 switches off. <p>rP1 is always smaller than SP1. The unit only accepts values which are lower than SP1.</p>	<i>r-P 1</i>

9.3.3 Scale analogue value for OUT2

<ul style="list-style-type: none"> ▶ Set the minimum pressure requested in the system. ▶ Touch [Mode/Enter] until [tASP] appears. ▶ Touch [Set] and keep it touched. <ul style="list-style-type: none"> > Current setting value flashes. ▶ Release [Set] when the display stops flashing. <ul style="list-style-type: none"> > New setting value is displayed. ▶ Touch [Mode/Enter] briefly. <ul style="list-style-type: none"> > The current system pressure is defined as start value for the analogue signal. 	<i>tASP</i>
<ul style="list-style-type: none"> ▶ Set the maximum pressure requested in the system. ▶ Touch [Mode/Enter] until [tAEP] appears. ▶ Touch [Set] and keep it touched. <ul style="list-style-type: none"> > Current setting value flashes. ▶ Release [Set] when the display stops flashing. <ul style="list-style-type: none"> > New setting value is displayed. ▶ Touch [Mode/Enter] briefly. <ul style="list-style-type: none"> > The current system pressure is defined as end value for the analogue signal. 	<i>tAEP</i>
<p>ASP / AEP can only be set automatically within defined limits (→ 12.1 Setting ranges). If automatic setting is carried out at an invalid pressure value, [UL] or [OL] is displayed. After acknowledgement by [Mode/Enter] [Err] flashes, the ASP value / AEP value is not changed.</p>	

<p>As an alternative:</p> <ul style="list-style-type: none"> ▶ Select [ASP] and set the measured value at which 4 mA is provided (20 mA at [OU2] = [InEG]). ▶ Select [AEP] and set the measured value at which 20 mA is provided (4 mA at [OU2] = [InEG]). <p>Minimum distance between ASP and AEP = 25 % of the final value of the measuring range (turn-down 1:4).</p>	ASP AEP
--	------------

9.4 User settings (optional)

9.4.1 Carry out zero point calibration

<ul style="list-style-type: none"> ▶ Select [COF] and set a value between -5 % and 5 % of the final value of the measuring range. The internal measured value "0" is shifted by this value. 	COF
<p>As an alternative: automatic adjustment of the offset in the range 0 bar \pm 5 %.</p> <ul style="list-style-type: none"> ▶ Make sure that no pressure is applied to the system. ▶ Touch [Mode/Enter] until [tCOF] appears. ▶ Touch [Set] and keep it touched. <p>> The current offset value (in %) flashes briefly. > The current system pressure is displayed.</p> <ul style="list-style-type: none"> ▶ Release [Set]. ▶ Touch [Mode/Enter] briefly (= to confirm the new offset value). 	tCOF

9.4.2 Set delay time for OUT1

<p>[dS1] = switch-on delay / [dr1] = switch-off delay.</p> <ul style="list-style-type: none"> ▶ Select [dS1] or [dr1] and set a value between 0.1 and 50 s (at 0.0 the delay time is not active). 	dS 1 dr 1
--	--------------


9.4.3 Set switching logic for OUT1

<ul style="list-style-type: none"> ▶ Select [P-n] and set [PnP] or [nPn]. 	P--n
--	------

9.4.4 Set damping for the switching signal

<ul style="list-style-type: none"> ▶ Select [dAP] and set a value between 0.01 and 30 s. <p>dAP value = response time between pressure change and change of the switching status in seconds.</p> <p>[dAP] influences the switching frequency: $f_{\max} = 1 \div 2dAP$.</p> <p>[dAP] also has an effect on the display.</p>	dAP
---	-----

9.4.5 Set damping for the analogue signal



<p>► Select [dAA] and set a value between 0.01 and 30 s. dAA value = response time between pressure change and change of the analogue signal in seconds.</p>	
--	---

9.4.6 Calibrate curve of measured values

If the unit is to adopt the settings for the calibration points, the following conditions must be adhered to:


- CP1 and CP2 must be within the measuring range (i.e. between ASP and AEP).
- CP1 and CP2 must not be in the extended display range.
- Minimum distance between the calibration points CP1 and CP2 = 5 % of the final value of the measuring range.
- Maximum correction value = ± 2 % of the final value of the measuring range.

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<p>► Set a defined reference pressure between ASP and AEP in the system. ► Select [CAL]. ► Touch [Set] briefly. > [CP1] is displayed. ► Touch [Set] for 5 s. > The pressure measured by the unit is displayed. ► Touch [Set] until the set reference pressure is indicated (measured pressure = reference pressure) or the corresponding analogue signal is provided to OUT2. ► Touch [Mode/Enter] briefly. > [CP1] is displayed. ► Touch [Mode/Enter] briefly. > [CP2] is displayed. Continue with a) or b).</p>	
<p>a) Finish calibration: ► Touch [Mode/Enter] briefly. > [CAL] is displayed. b) Change a 2nd point on the curve of measured values: ► Set a second defined reference pressure in the system. ► Touch [Set] for 5 s. > The pressure measured by the unit is displayed. ► Touch [Set] until the set reference pressure is indicated (measured pressure = reference pressure) or the corresponding analogue signal is provided to OUT2. ► Touch [Mode/Enter] briefly. > [CP2] is displayed. ► Touch [Mode/Enter] briefly. > [CAL] is displayed, the process is finished.</p>	

9.5 Service functions

9.5.1 Read min/max values for system pressure

<ul style="list-style-type: none">▶ Select [HI] or [LO] and touch [Set] briefly. [HI] = maximum value, [LO] = minimum value. Delete memory:<ul style="list-style-type: none">▶ Select [HI] or [LO].▶ Touch [Set] and keep it touched until [----] is displayed.▶ Touch [Mode/Enter] briefly.	
--	---

9.5.2 Reset all parameters to factory setting

<ul style="list-style-type: none">▶ Select [rES].▶ Touch [Set] and keep it touched until [----] is displayed.▶ Touch [Mode/Enter] briefly. <p>It is recommended to take down your own settings in the table before carrying out a reset (→13 Factory setting).</p>	
--	---

10 Operation

After power on, the unit is in the Run mode (= normal operating mode). It carries out its measurement and evaluation functions and provides output signals according to the set parameters.

Operating indicators → 7 Operating and display elements.

Reset the lag indicator (if [LED] = [HInd] or [LInd]):

- ▶ Touch [Set] for 1 second.
- > The two lag indicator LEDs jump to the current position of the pointer.

10.1 Read set parameters

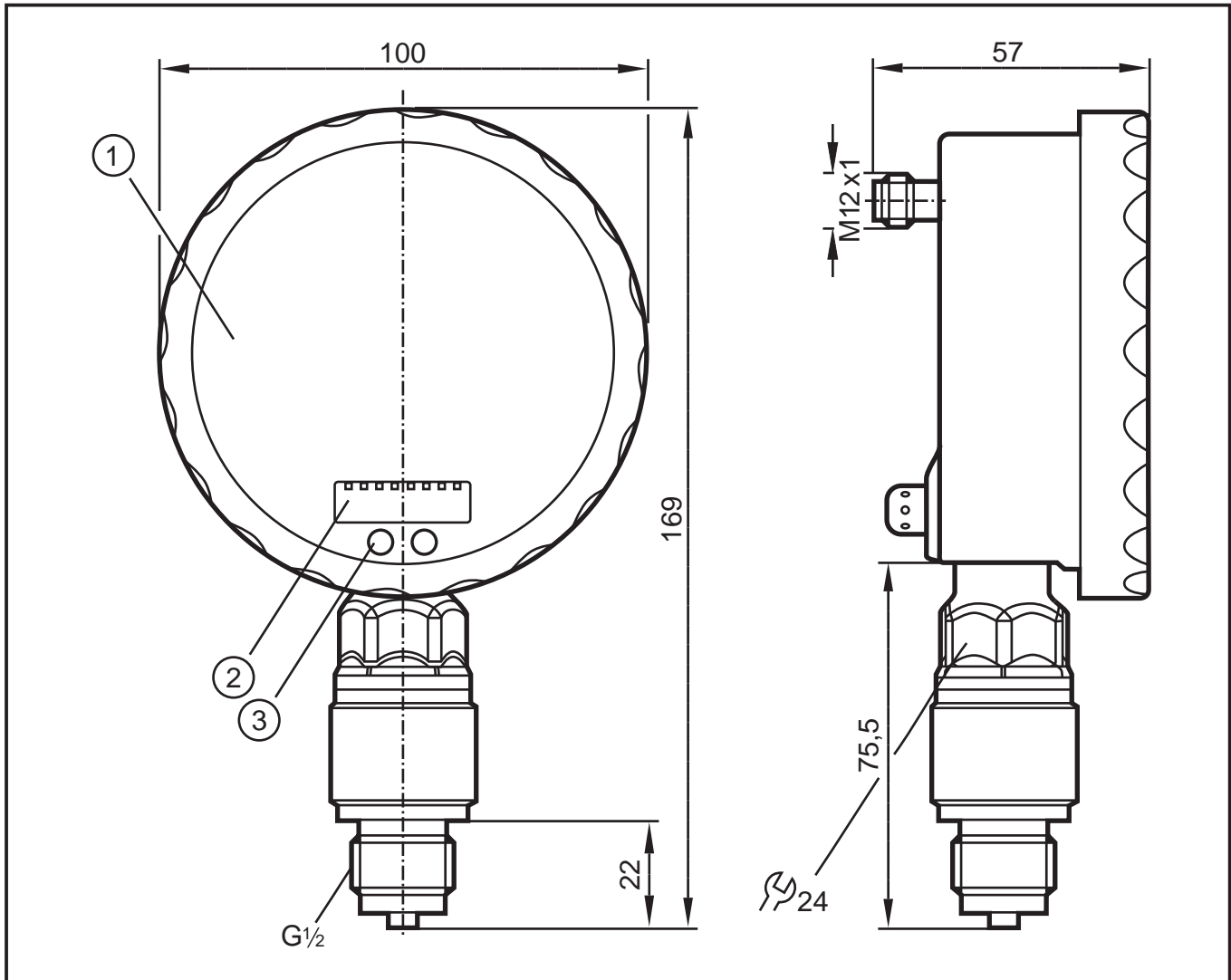
- ▶ Touch [Mode/Enter] until the requested parameter is displayed.
- ▶ Touch [Set] briefly.
- > The unit displays the corresponding parameter value for about 15 s. After another 15 s it returns to the Run mode.

10.2 Error indications

[OL]	Overload pressure (measuring range exceeded).
[UL]	Underload pressure (below measuring range).
[SC1]	Short circuit in OUT1. The output is switched off as long as the short circuit persists.
[Err]	Flashing: internal error, invalid entry.

The messages SC1 and Err are displayed even if the display is switched off.

11 Scale drawing



Dimensions in mm

1: analogue display

2: digital display

3: touch button (programming button)

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12 Technical data

Operating voltage [V].....	18...32 DC	
Current consumption [mA].....	< 70 (24 V)	
Current rating [mA]	250	
Short-circuit protection; reverse polarity protection / overload protection, integrated watchdog		
Voltage drop [V]	< 2	
Power-on delay time [s]	6	
Min. response time switching output [ms]	9	
Switching frequency [Hz]	75	
Analogue output	4...20 mA / 20...4 mA	
Max. load [Ω]	(U _b - 10) x 50	
Step response time analogue output [ms]	28	
Accuracy / deviations (in % of the span) ¹⁾		
	PG2409 PG2452 ... PG2458	PG2450 PG2451 PG2489
Switch point accuracy	< ± 0.5	< ± 0.6
Switch point accuracy in the extended display range	< ± 1.5	< ± 1.5
Characteristics deviation	< ± 0.25 (BFSL) < ± 0.5 (LS)	< ± 0.35 (BFSL) < ± 0.6 (LS)
Hysteresis	< 0.25	< 0.5
Repeatability (in case of temperature fluctuations < 10 K)	< ± 0.1	< ± 0.1
Long-term stability (in % of the span / 6 months)	< ± 0.1	< ± 0.1
Temperature coefficients (TEMPCO) in the compensated temperature range 0 ...70°C (in % of the span per 10 K)		
	PG2409 PG2452 ... PG2458	PG2450 PG2451 PG2489
Greatest TEMPCO of the zero point	< ± 0.2	< ± 0.3
Greatest TEMPCO of the span	< ± 0.2	< ± 0.3

Materials (wetted parts)	stainless steel 316L / 1.4404 ceramics (Al ₂ O ₃); FPM
Housing materials.....	stainless steel 316L / 1.4404; PA; FPM (Viton); PTFE; viewing glass: laminated safety glass 4 mm
Protection rating	IP 67 / IP 69K
Protection class	III
Insulation resistance [MΩ]	> 100 (500 V DC)
Shock resistance [g]	50 (DIN IEC 68-2-27, 11 ms)
Vibration resistance [g]	20 (DIN IEC 68-2-6, 10 - 2000 Hz)
Switching cycles min.	100 million
Ambient temperature [°C]	-20 ... 80
Medium temperature [°C]	-25...80
Storage temperature [°C]	-40...100
EMC EN 61000-4-2 ESD:	4 / 8 kV
EN 61000-4-3 HF radiated:	10 V/m
EN 61000-4-4 Burst:	2 kV
EN 61000-4-5 Surge:	0.5 / 1 kV
EN 61000-4-6 HF conducted:	10 V

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¹⁾ 1) All indications are referred to a turn-down of 1:1

13 Setting ranges

		SP1		rP1		ASP		AEP		ΔP
		min	max	min	max	min	max	min	max	
PG2409	bar	-0.992	1.600	-1.000	1.592	-1.000	1.100	-0.500	1.600	0.004
	PSI	-14.40	23.22	-14.52	23.10	-14.52	15.96	-7.26	23.22	0.06
PG2450	bar	2	600	0	598	0	500	100	600	1
	PSI	30	8700	0	8670	0	7250	1450	8700	10
PG2451	bar	1.0	400.0	0.0	399.0	0.0	350.0	50.0	400.0	0.5
	PSI	15	5800	0	5785	0	5075	725	5800	5
PG2452	bar	0.4	160.0	0.0	159.6	0.0	135.0	25.0	160.0	0.2
	PSI	6	2322	0	2316	0	1959	363	2322	3

ΔP = step increment

		SP1		rP1		ASP		AEP		ΔP
		min	max	min	max	min	max	min	max	
PG2453	bar	-0.90	40.00	-1.00	39.90	-1.00	33.75	5.25	40.00	0.05
	PSI	-13.0	580.0	-14.5	578.5	-14.5	489.5	76.0	580.0	0.5
PG2454	bar	-0.96	16.00	-1.00	15.96	-1.00	13.50	1.50	16.00	0.02
	PSI	-14.0	232.0	-14.4	231.6	-14.4	195.8	21.8	232.0	0.2
PG2455	bar	-0.98	6.40	-1.00	6.38	-1.00	5.40	0.00	6.40	0.01
	PSI	-14.2	92.8	-14.5	92.5	-14.5	78.3	0.0	92.8	0.1
PG2456	bar	-0.115	4.000	-0.125	3.990	-0.125	3.350	0.525	4.000	0.005
	PSI	-1.65	58.00	-1.80	57.85	-1.80	48.60	7.60	58.00	0.05
PG2457	bar	-0.046	1.600	-0.050	1.596	-0.050	1.340	0.200	1.600	0.002
	PSI	-0.66	23.20	-0.72	23.14	-0.72	19.58	2.90	23.20	0.02
PG2458	mbar	-11.5	400.0	-12.5	399.0	-12.5	337.5	50.0	400.0	0.5
	inH2O	-4.6	160.6	-5.0	160.2	-5.0	135.6	20.0	160.6	0.2
PG2489	mbar	-4.6	160.0	-5.0	159.6	-5.0	135.0	20.0	160.0	0.2
	inH2O	-1.84	64.24	-2.00	64.08	-2.00	54.24	8.00	64.24	0.08

ΔP = step increment

14 Factory setting

	Factory setting	User setting
SP1	25.0 % VMR*	
rP1	24.9 % VMR*	
OU1	Hno	
OU2	I	
COF / tCOF	0.0	
ASP / tASP	0 % VMR*	
AEP / tAEP	100 % VMR*	
Uni	bAr / mbAr	
SELd	P	
dS1	0.0	
dr1	0.0	
P-n	pnP	
dAP	0.06	
dAA	0.03	
dis	d2	
LED	SPRP	
CP1	0.00	
CP2	0.00	

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* = the indicated percentage of the final value of the measuring range (VMR) of the corresponding sensor is set.

More information at www.ifm.com

APPENDIX F

Material Safety Data Sheets

MATERIAL SAFETY DATA SHEET**Aluminium Sulphate Solution****Section 01 - Chemical And Product And Company Information**

Product Identifier Aluminium sulphate solution

Product Use Coagulating agent in municipal and industrial water and wastewater treatment, additive in papermaking.

Supplier Name ClearTech Industries Inc.
2302 Hanselman Avenue
Saskatoon, SK. S7L 5Z3
Canada

Prepared By ClearTech Industries Inc. Technical Department
Phone: (306)664-2522

Preparation Date November 26, 2009

24-Hour Emergency Phone 306-664-2522

**Section 02 - Composition / Information on Ingredients**

Hazardous Ingredients Aluminum sulphate hydrate 45-55%

CAS Number Aluminum sulphate hydrate 16828-12-9

Synonym (s) Liquid alum; aluminum sulfate solution; papermaker's alum; sulphuric acid, aluminum salt.

Section 03 - Hazard Identification

Inhalation Inhalation of mists can be irritating to the respiratory tract and lungs.



- Skin Contact / Absorption**..... Mild to moderate irritation can occur. Aluminum is very poorly absorbed through the skin and toxic effects would not be expected following short-term skin contact.
- Eye Contact**..... May result in mild to moderate irritation to eyes.
- Ingestion**..... Amounts ingested incidental to industrial handling are not likely to cause injury. Large amounts may cause abdominal pain, nausea, vomiting. Can cause burns of the mouth, bleeding stomach, incoordination, muscle spasms, and kidney injury.
- Exposure Limits**..... ACGIH/TLV-TWA= 2mg/m³(Soluble Aluminum Salts)
OSHA/PEL-TWA= 2mg/m³(Soluble Aluminum Salts)

Section 04 - First Aid Measures

- Inhalation**..... Remove victim to fresh air. Give artificial respiration only if breathing has stopped. If breathing is difficult, give oxygen. Seek immediate medical attention.
- Skin Contact / Absorption**..... Remove contaminated clothing. Wash affected area with soap and water. Seek medical attention if irritation occurs or persists.
- Eye Contact**..... Flush immediately with water for at least 20 minutes. Forcibly hold eyelids apart to ensure complete irrigation of eye tissue. Seek immediate medical attention.
- Ingestion**..... Do not induce vomiting. If vomiting occurs, lean victim forward to prevent breathing in vomitus. Give large amounts of water. Do not give anything by mouth to an unconscious or convulsing person. Seek immediate medical attention.
- Additional Information**..... Not available

Section 05 - Fire Fighting

- Conditions of Flammability**..... Non-flammable
- Means of Extinction**..... Product itself does not burn. However, decomposition product sulfur trioxide will react with water to form sulfuric acid. Use appropriate extinguishing agent.
- Flash Point**..... Not applicable



Auto-ignition Temperature..... Not applicable

Upper Flammable Limit Not applicable

Lower Flammable Limit..... Not applicable

Hazardous Combustible Products... Under fire conditions (or at temperatures greater than 650°C), product decomposes to give off sulfur trioxide, an oxidizing agent which will support combustion.

Special Fire Fighting Procedures..... Wear NIOSH-approved self-contained breathing apparatus and protective clothing.

Explosion Hazards..... Liquid alum may react with some metals, to give flammable, potentially explosive hydrogen gas. Hydrogen gas can accumulate to explosive concentrations inside confined spaces. Follow appropriate NFPA codes.

Section 06 - Accidental Release Measures

Leak / Spill..... Wear appropriate personal protective equipment. Ventilate area. Stop or reduce leak if safe to do so. Prevent material from entering sewers. Cover spill with dry earth, sand or other non-combustible material.

Deactivating Materials..... Lime, limestone, soda ash, sodium bicarbonate, dilute sodium hydroxide or dilute aqua ammonia.

Section 07 - Handling and Storage

Handling Procedures..... Use proper equipment for lifting and transporting all containers. Use sensible industrial hygiene and housekeeping practices. Wash thoroughly after handling. Avoid all situations that could lead to harmful exposure.

Storage Requirements..... Store in a cool, dry, well-ventilated place. Keep container tightly closed, and away from incompatible materials. Store at temperatures below 40°C and above 0°C.

Section 08 - Personal Protection and Exposure Controls

Protective Equipment

Eyes..... Chemical goggles, full-face shield, or a full-face respirator is to be worn at all times when product is handled. Contact lenses should not be worn; they may contribute to severe eye injury.



- Respiratory**..... A NIOSH/MSHA approved air-purifying respirator equipped with acid gas/fume, mist cartridges for concentrations up to 20 mg/m³. An air-supplied respirator if concentrations are higher or unknown.
- Gloves**..... Impervious gloves of chemically resistant material (rubber or PVC) should be worn at all times. Wash contaminated clothing and dry thoroughly before reuse.
- Clothing**..... Body suits, aprons, and/or coveralls of chemical resistant material should be worn at all times. Wash contaminated clothing and dry thoroughly before reuse.
- Footwear**..... Impervious boots of chemically resistant material should be worn at all times.

Engineering Controls

- Ventilation Requirements**..... Mechanical ventilation (dilution or local exhaust), process or personnel enclosure and control of process conditions should be provided. Supply sufficient replacement air to make up for air removed by exhaust systems.
- Other**..... Emergency shower and eyewash should be in close proximity.

Section 09 - Physical and Chemical Properties

- Physical State**..... Liquid
- Odor and Appearance**..... Pale straw coloured, clear odourless liquid.
- Odor Threshold**..... Not available
- Specific Gravity (Water=1)**..... 1.335
- Vapor Pressure (mm Hg, 20C)**..... Not available
- Vapor Density (Air=1)**..... Not available
- Evaporation Rate**..... Not available
- Boiling Point**..... 101°C
- Freeze/Melting Point**..... -16°C
- pH**..... 1.9-2.3



Water/Oil Distribution Coefficient.... Not available

Bulk Density..... Not available

% Volatiles by Volume..... Not available

Solubility in Water..... Completely miscible

Molecular Formula..... $\text{Al}_2(\text{SO}_4)_3 \cdot 14\text{H}_2\text{O}$

Molecular Weight..... 594.14

Section 10 - Stability and Reactivity

Stability..... Stable under normal conditions.

Incompatibility..... Corrosive to carbon steel, aluminum, and zinc. Reacts with strong bases to form aluminum hydroxide.

Hazardous Products of Decomposition.. May react with many metals including carbon steel and aluminum to form flammable gases including sulphur oxides and hydrogen. Liquid alum is stable below 60°C.

Polymerization..... Will not occur

Section 11 - Toxicological Information

Irritancy..... Corrosive

Sensitization..... Not available

Chronic/Acute Effects..... Skin irritation may be aggravated in individuals with existing skin lesions. Breathing of vapors or sprays (mists) may aggravate acute or chronic asthma and chronic pulmonary disease such as emphysema and bronchitis.

Synergistic Materials..... Not available

Animal Toxicity Data..... $\text{LD}_{50}(\text{mouse, oral}) = >9000 \text{ mg/kg}$
 $\text{LD}_{50}(\text{rat, oral}) = >9000 \text{ mg/kg}$

Carcinogenicity..... Sulfuric acid mist: Classified 1 (Proven for humans) by IARC, 1 (Known to be human carcinogens) by NTP
Sulfuric acid mist: Classified A2 (Suspected for humans) by ACGIH



Reproductive Toxicity..... Not available

Teratogenicity..... Not available

Mutagenicity..... Not available

Section 12 - Ecological Information

Fish Toxicity..... LD₅₀(72 hrs, goldfish)= 100mg/L

Biodegradability..... The products of biodegradation are more toxic than the original product.

Environmental Effects..... May be harmful to aquatic life. Toxicity is primarily associated with the acidic pH. Acidic soil conditions develop where contamination with this material occurs.

Section 13 - Disposal Consideration

Waste Disposal..... Dispose in accordance with all federal, provincial, and/or local regulations including the Canadian Environmental Protection Act.

Section 14 - Transportation Information

TDG Classification

Class..... 8

Group..... III

PIN Number..... UN 3264

Other..... Secure containers (full and/or empty) with suitable hold down devices during shipment.

Section 15 - Regulatory Information

WHMIS Classification.....E

NOTE: THE PRODUCT LISTED ON THIS MSDS HAS BEEN CLASSIFIED IN ACCORDANCE WITH THE HAZARD CRITERIA OF THE CANADIAN CONTROLLED PRODUCTS REGULATIONS. THIS MSDS CONTAINS ALL INFORMATION REQUIRED BY THOSE REGULATIONS.

NSF Certification.....Product is certified under NSF/ANSI Standard 60 for coagulation and flocculation at a maximum dosage of 330mg/L.

Section 16 - Other Information

Note: The responsibility to provide a safe workplace remains with the user. The user should consider the health hazards and safety information contained herein as a guide and should take those precautions required in an individual operation to instruct employees and develop work practice procedures for a safe work environment. The information contained herein is, to the best of our knowledge and belief, accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by the use of this material. It is the responsibility of the user to comply with all applicable laws and regulations.

Attention: Receiver of the chemical goods / MSDS coordinator

As part of our commitment to the Canadian Association of Chemical Distributors (CACD) Responsible Distribution[®] initiative, ClearTech Industries Inc. and its associated companies require, as a condition of sale, that you forward the attached Material Safety Data Sheet(s) to all affected employees, customers, and end-users. ClearTech will send any available supplementary handling, health, and safety information to you at your request.

If you have any questions or concerns please call our customer service or technical service department.

ClearTech Industries Inc. - Locations

Corporate Head Office: 2302 Hanselman Avenue, Saskatoon, SK, S7L 5Z3

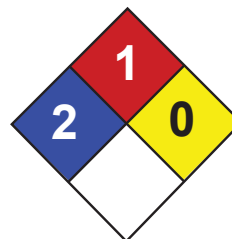
Phone: 306-664-2522

Fax: 306-665-6216

www.ClearTech.ca

Location	Address	Postal Code	Phone Number	Fax Number
Richmond, B.C.	12431 Horseshoe Way	V7A 4X6	604-272-4000	604-272-4596
Calgary, AB.	5516E - 40 th St. S.E.	T2C 2A1	403-279-1096	403-236-0989
Edmonton, AB.	11750 - 180 th Street	T5S 1N7	780-452-6000	780-452-4600
Saskatoon, SK.	2302 Hanselman Avenue	S7L 5Z3	306-933-0177	306-933-3282
Regina, SK.	555 Henderson Drive	S42 5X2	306-721-7737	306-721-8611
Winnipeg, MB.	340 Saulteaux Crescent	R3J 3T2	204-987-9777	204-987-9770
Mississauga, ON.	7480 Bath Road	L4T 1L2	905-612-0566	905-612-0575

24 Hour Emergency Number - All Locations - 306-664-2522



Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Citric acid MSDS

Section 1: Chemical Product and Company Identification

Product Name: Citric acid

Catalog Codes: SLC5449, SLC2665, SLC4453, SLC1660, SLC3451

CAS#: 77-92-9

RTECS: GE7350000

TSCA: TSCA 8(b) inventory: Citric acid

CI#: Not available.

Synonym: 2-Hydroxy-1,2,3-propanetricarboxylic acid

Chemical Name: Citric Acid

Chemical Formula: C₆H₈O₇

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Citric acid	77-92-9	100

Toxicological Data on Ingredients: Citric acid: ORAL (LD50): Acute: 5040 mg/kg [Mouse]. 3000 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of eye contact (irritant), of inhalation (lung irritant). Slightly hazardous in case of skin contact (irritant, sensitizer), of ingestion. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Severe over-exposure can produce lung damage, choking, unconsciousness or death.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to teeth. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 1010°C (1850°F)

Flash Points: Not available.

Flammable Limits: LOWER: 0.28 Kg/M3 (Dust) UPPER: 2.29 Kg/M3 (Dust)

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:

Slightly flammable to flammable in presence of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Slightly explosive in presence of open flames and sparks. Non-explosive in presence of shocks.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: As with most organic solids, fire is possible at elevated temperatures

Special Remarks on Explosion Hazards:

Fine dust dispersed in air in sufficient concentrations, and in the presences of an ignition source is a potential dust explosion hazard.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe dust. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, reducing agents, metals, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Safety glasses. Lab coat. Gloves (impervious). Dust respirator. Be sure to use an approved/certified respirator or equivalent. The dust respirator should be used for conditions where exposure has exceeded recommended exposure limits, dust is apparent, and engineering controls (adequate ventilation) are not feasible.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

No exposure guidelines have been established. ACGIH, NIOSH and OSHA have not developed exposure limits for this product. The exposure limits given below are for particulates not otherwise classified: ACGIH: 10 mg/m³ TWA (Total Inhalable fraction); 3 mg/m³ TWA (Respirable fraction) OSHA: 15 mg/m³ TWA (Total dust); 5 mg/m³ TWA (Respirable Fraction)

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Crystalline powder)

Odor: Odorless.

Taste: Acid. (Strong.)

Molecular Weight: 192.13 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: Decomposes.

Melting Point: 153°C (307.4°F)

Critical Temperature: Not available.

Specific Gravity: 1.665 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: The product is more soluble in water; log(oil/water) = -1.7

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility:

Soluble in cold water, hot water, diethyl ether. Insoluble in benzene.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, reducing agents, metals, alkalis.

Corrosivity:

Corrosive in presence of aluminum, of zinc, of copper. Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Incompatible with oxidizing agents, potassium tartrate, alkali, alkaline earth carbonates and bicarbonates, acetates, and sulfides, metal nitrates

Special Remarks on Corrosivity: Will corrode copper, zinc, aluminum and their alloys.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 3000 mg/kg [Rat].

Chronic Effects on Humans: May cause damage to the following organs: teeth.

Other Toxic Effects on Humans:

Hazardous in case of inhalation (lung irritant). Slightly hazardous in case of skin contact (irritant, sensitizer), of ingestion.

Special Remarks on Toxicity to Animals: LDL[Rabbit] - Route: oral; Dose: 7000mg/kg

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Causes mild to moderate skin irritation. May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material. Eyes: Causes moderate to severe eye irritation and possible injury. Ingestion: May cause gastrointestinal (digestive) tract irritation with nausea, vomiting, diarrhea. Excessive intake may cause erosion of teeth and hypocalcemia (calcium deficiency in blood). May affect behavior/central nervous system (tremor, convulsions, muscle contraction or spasticity). Inhalation: Causes moderate respiratory tract and mucous membrane irritation. Chronic Potential Health Effects: Frequent intake of citrated beverages may cause erosion of dental enamel and irritation of mucous membranes.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: TSCA 8(b) inventory: Citric acid

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS E: Corrosive solid.

DSCL (EEC):

R36/37/38- Irritating to eyes, respiratory system and skin. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37/39- Wear suitable gloves and eye/face protection.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: e

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves (impervious). Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

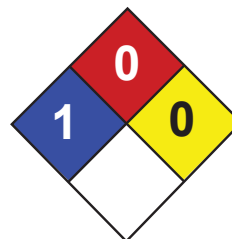
References: Not available.

Other Special Considerations: Not available.

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Last Updated: 05/21/2013 12:00 PM

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Health	3
Fire	0
Reactivity	0
Personal Protection	

Material Safety Data Sheet

Sodium Hypochlorite, 5% MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium Hypochlorite, 5%

Catalog Codes: SLS1654

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Sodium hypochlorite; Sodium hydroxide; Water

CI#: Not applicable.

Synonym: Chlorine Bleach, Bleach, Soda Bleach, Chlorox; Sodium Hypochlorite, Solution, 5% Available Chlorine

Chemical Name: Hypochlorous acid, sodium salt, solution

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium hypochlorite	7681-52-9	4-7
Sodium hydroxide	1310-73-2	<1
Water	7732-18-5	>92

Toxicological Data on Ingredients: Sodium hypochlorite: ORAL (LD50): Acute: 5800 mg/kg [Mouse]. 8910 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, . Hazardous in case of skin contact (corrosive), of eye contact (corrosive). Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Sodium hypochlorite]. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. [Sodium hypochlorite]. Mutagenic for mammalian somatic cells. [Sodium hydroxide]. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to lungs, mucous membranes, skin, eyes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection.

Section 4: First Aid Measures**Eye Contact:**

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: combustible materials, metals, organic materials

Explosion Hazards in Presence of Various Substances:

Slightly explosive in presence of open flames and sparks. Non-explosive in presence of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:

Releases chlorine when heated above 35 deg. C. The substance itself is non-combustible and does not burn. However, when heated to decomposition it emits corrosive and/or toxic fumes. May ignite combustibles. Fire risk in contact with organic materials. Contact with metals may evolve flammable hydrogen gas.

Special Remarks on Explosion Hazards:

Anydrous Sodium Hypochlorite is very explosive. Primary amines and calcium hypochlorite or sodium hypochlorite react to form normal chloroamines, which are explosive. Interaction of ethyleneimine with sodium (or other) hypochlorite gives the explosive N-chloro cmpd. Removal of formic acid from industrial waste streams with sodium hypochlorite soln becomes explosive at 55 deg C. Several explosions involving methanol and sodium hypochlorite were attributed to formation of methyl hypochlorite, especially in presence of acid or other esterification catalyst. Use of sodium hypochlorite soln to destroy acidified benzyl cyanide residues caused a violent explosion, thought to have been due to formation of nitrogen trichloride. (Sodium hypochlorite)

Section 6: Accidental Release Measures**Small Spill:**

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:

Corrosive liquid. Oxidizing material. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage**Precautions:**

Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Keep away from combustible material.. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as reducing agents, combustible materials, organic materials, metals, acids.

Storage:

Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles. See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizers. Air Sensitive Sensitive to light. Store in light-resistant containers.

Section 8: Exposure Controls/Personal Protection**Engineering Controls:**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:

Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

Sodium hypochlorite TWA: 1 CEIL: 1 (ppm as Cl₂) STEL: 1 (ppm as Cl₂) from ACGIH (TLV) [United States] Sodium hydroxide STEL: 2 (mg/m³) from ACGIH (TLV) [United States] TWA: 2 CEIL: 2 (mg/m³) from OSHA (PEL) [United States] CEIL: 2 (mg/m³) from NIOSH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Characteristic. Chlorine-like (Slight.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light greenish yellow

pH (1% soln/water): Neutral.

Boiling Point: Decomposition temperature: 40°C (104°F)

Melting Point: Not available.

Critical Temperature: Not available.

Specific Gravity: 1.07 - 1.093 (Water = 1)

Vapor Pressure: 2.3 kPa (@ 20°C)

Vapor Density: The highest known value is 0.62 (Air = 1) (Water).

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials. light, air, heat

Incompatibility with various substances: Reactive with reducing agents, combustible materials, organic materials, metals, acids.

Corrosivity:

Extremely corrosive in presence of aluminum. Corrosive in presence of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Decomposed by carbon dioxide from air. Slowly decomposes on contact with air. Unstable in air unless mixed with sodium hydroxide. Incompatible with ammonium acetate, ammonium carbonate, ammonium nitrate, ammonium oxalate, and ammonium phosphate. Decomposition of sodium hypochlorite takes place within a few seconds with these salts. Also incompatible with primary amines, phenyl acetonitrile, ethyleneimine, methanol, acidified benzyl cyanide, formic acid, urea, nitro compounds, methylcellulose, cellulose, aziridine, ether, ammonia. Mixing this product with chemicals (e.g. ammonia, acids, detergents, etc.) or organic matter (e.g. urine, feces, etc.) will release chlorine gas. Chloramine gas may be evolved when ammonia and bleach are mixed. Decomposed by hot water. Sensitive to light. Exposure to light accelerates decomposition.

Special Remarks on Corrosivity:

Sodium Hypochlorite is extremely corrosive to brass, and moderately corrosive to bronze. There is no corrosivity information for copper.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 5800 mg/kg [Mouse]. (Sodium hypochlorite).

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Sodium hypochlorite]. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. [Sodium hypochlorite]. Mutagenic for mammalian somatic cells. [Sodium hydroxide]. Contains material which may cause damage to the following organs: lungs, mucous membranes, skin, eyes.

Other Toxic Effects on Humans:

Very hazardous in case of skin contact (irritant), of ingestion, . Hazardous in case of skin contact (corrosive), of eye contact (corrosive). Slightly hazardous in case of inhalation (lung sensitizer, lung corrosive).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: May affect genetic material (mutagenic) (Sodium hypochlorite)

Special Remarks on other Toxic Effects on Humans:

Potential Health Effects: Can cause severe irritation and possible burns to skin and eyes. Eye contact may also cause corneal and conjunctival edema, conjunctival hemorrhages. Contact with skin may also cause vesicular eruptions and eczematoid dermatitis which becomes evident upon re-exposure. Prolonged or repeated eye contact may cause conjunctivitis. Ingestion can cause burns to the digestive tract. Symptoms may include: 1. pain and inflammation of the mouth, pharynx, esophagus, and stomach, 2. erosion of the mucous membranes (chiefly of the stomach), nausea, vomiting, choking, coughing, hemorrhage, 3. circulatory collapse with cold and clammy skin (due to methemoglobinemia), cyanosis, and shallow respirations, 4. confusion, delirium, coma, 5. edema of the pharynx, glottis, larynx with stridor and obstruction, 6. perforation of the esophagus, or stomach, with mediastinitis or peritonitis. Inhalation causes slight to severe respiratory tract irritation and delayed pulmonary edema. Prolonged or repeated inhalation may cause allergic respiratory reaction (asthma).

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Dilute with water and flush to sewer if local ordinances allow, otherwise, whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Hypochlorite solution UNNA: 1791 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Illinois toxic substances disclosure to employee act: Sodium hydroxide Illinois chemical safety act: Sodium hydroxide New York release reporting list: Sodium hydroxide Rhode Island RTK hazardous substances: Sodium hydroxide Pennsylvania RTK: Sodium hypochlorite; Sodium hydroxide Florida: Sodium hypochlorite Minnesota: Sodium hypochlorite; Sodium hydroxide Massachusetts RTK: Sodium hypochlorite; Sodium hydroxide New Jersey: Sodium hypochlorite; Sodium hydroxide Louisiana spill reporting: Sodium hydroxide TSCA 8(b) inventory: Sodium hypochlorite; Sodium hydroxide; Water CERCLA: Hazardous substances.: Sodium hypochlorite: 100 lbs. (45.36 kg); Sodium hydroxide: 1000 lbs. (453.6 kg);

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS E: Corrosive liquid.

DSCL (EEC):

R8- Contact with combustible material may cause fire. R31- Contact with acids liberates toxic gas. R36/38- Irritating to eyes and skin. S28- After contact with skin, wash immediately with plenty of water. S36/37/39- Wear suitable protective clothing, gloves and eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 0

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 06:32 PM

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Material Safety Data Sheet

H.M.I.S.
Health: 0
Flammability: 1
Reactivity: 0
These ratings should be used only as a part of a fully implemented H.M.I.S. program.

Section I - Product Identification

Trade Name and Synonyms AEON-PD	Part Numbers: 28G23; 28G24; 28G25; 28G28; 28G40; 28G41	Health Emergency Phone Number (217) 222-5400 Safety Department
Manufacturer's Name Gardner Denver, Inc.		
Address 1800 Gardner Expressway - Quincy, IL 62305		
Product Identification Positive Displacement Blower Lubricant		Transport Emergency Phone Number (800) 424-9300 (CHEMTREC)
Chemical Names and Synonyms Polyalphaolefin	Use or Description Gear Oil	

Section II - Composition/Information on Ingredients

Chemical Family:	Synthetic Hydrocarbon	CAS Number	Proprietary
Formula:	C ₁₀ H ₂₀ n+2		

Section III - Chemical and Physical Properties

Appearance:	Blue Liquid	Specific Gravity:	(water=1):0.84-0.89
Odor:	None	Vapor Pressure:	<0.01mmHg@20°C
Volatile, Percent by Volume:	0%	Solubility in Water:	Insoluble
Boiling Point:	>600°F	Evaporation Rate (butyl acetate=1):	Nil

Section IV - Hazards Identification

Threshold Limit Value:	5mg/m ³ ACGIH
Situations to Avoid	Avoid breathing oil mists.
This product is non-hazardous. The product contains no known carcinogens. No special warning labels are required under OSHA 29 CFR 1910. 1200.	

Section V - First Aid Measures

Eye Contact:	Flush eyes with water for 15 minutes and consult physician.
Skin Contact:	Upon contact with skin, wash with soap and water.
Inhalation:	Product is not toxic by inhalation. If oil mist is inhaled, remove to fresh air and consult physician.
Ingestion:	Consult physician at once. DO NOT INDUCE VOMITING. May cause nausea and diarrhea.
To the best of our knowledge the toxicity of this product has not been fully investigated. Analogous compounds are considered to be essentially non-toxic.	

Section VI - Fire Fighting Measures

Flash Point: 405-495°F	Method: Cleveland Open Cup - COC
Flammable Limits:	Not established
Autoignition Temperature:	No data
Extinguishing Media:	Dry chemical; CO ₂ foam; water spray (fog)
Fire Fighting Instructions:	Burning fluid may evolve irritating/noxious fumes. Firefighters should use NIOSH/MNSA Approved self-contained breathing apparatus. Use water to cool fire-exposed containers. Use water carefully near exposed liquid to avoid frothing and splashing of hot liquid.
NFPA Classification:	Not established

Section VII - Stability and Reactivity

Chemical Stability	Stable
Conditions to Avoid:	Excessive heat
Incompatibility with other Materials:	Strong oxidizers
Hazardous Decomposition Products:	Analogous compounds evolve carbon monoxide, carbon dioxide, and other unidentified fragments when burned.
Hazardous Polymerization:	Will not occur.

Section VIII - Accidental Release Measures

Safeguards (Personnel):	Wear suitable protective equipment, especially goggles.
Initial Containment:	Stop source of spill. Dike spill area. Use absorbent materials to soak up fluid (i.e. sand, sawdust, and commercially available materials.)
Spill Clean-Up:	Wash spill area with large amount of water. Properly dispose of all materials

Section IX - Handling and Storage

Handling (Personnel):	Do not take internally. Avoid contact with skin, eyes, and clothing. Upon contact with skin, wash with soap and water. Flush eyes with water for 15 minutes and consult physician. Wash contaminated clothing before reuse.
Handling (Physical Aspects):	
Storage:	Keep container tightly sealed when not in use.

Section X - Exposure Controls/Personal Protection

ENGINEERING CONTROLS:	
Ventilation:	Local exhaust
PERSONAL PROTECTIVE EQUIPMENT:	
Respiratory Protection:	Use in well ventilated area
Protective Gloves:	Not required, but recommended, especially for prolonged exposure.
Eye Protection:	Goggles
Other Protective Equipment:	
EXPOSURE GUIDELINES:	
Applicable Exposure Limits:	

Section XI - Toxicological Information

Animal Data:	No specific animal toxicological data available for this product.
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Section XII - Ecological Information

Ecotoxicological Information:	No specific aquatic data available for this product.
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Section XIII - Disposal Considerations

Waste Disposal:	Incinerate this product and all associated wastes in a licensed facility in accordance with Federal, state, and local regulations.
Container Disposal:	

Section XIV - Transportation Information

Shipping Information:	DOT - Not regulated. ICAO/IMO - Not restricted.
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Section XV - Regulatory Information

U.S. FEDERAL REGULATIONS:	
OSHA Hazard Determination:	Under normal conditions of use, this material is not known to be hazardous as defined by OSHA's Hazard Communication Standard, 29 CFR 1910.1200.
CERCLA/Superfund:	This material is not known to contain hazardous substances in sufficient quantity to make it subject to CERCLA regulations.
SARA, Title III, 302/304:	This material is not known to contain extremely hazardous substances.
Title III Hazard Classifications Sections 311, 312:	Acute: No Chronic: No Reactivity: No Pressure: No Fire: No
SARA Title III, 313:	This material is not known to contain any chemical(s) at a level of 1.0% or greater (0.1% for carcinogens) on the list of Toxic Chemicals and subject to release reporting requirements.
TSCA:	Material and/or components are listed in the TSCA Inventory of Chemical Substances (40 CFR 710).
RCRA:	This material has been evaluated for RCRA characteristics and does not meet hazardous waste criteria if discarded in its purchased form. Because of product use, transformation, mixing, processing, etc., which may render the resulting material hazardous, it is the product user's responsibility to determine at the time of disposal whether the material meets RCRA hazardous waste criteria.
Clean Water Act:	This material is not known to contain any ingredient(s) subject to the Act.
STATE REGULATIONS (U.S.):	
California "Prop 65":	Product may contain ingredient(s) known to the State of California to cause cancer, birth defects, or other reproductive harm, but the degree of exposure poses a health risk that is below the Prop 65 No Significant Risk Level for the listed chemical(s).
Pennsylvania Worker & Community Right to Know Act:	This material is not known to contain any ingredient(s) subject to the Act.
CANADIAN REGULATIONS:	This is not a WHMIS controlled product. Transport/Medical Emergency Phone Number: 613-348-3616.

Section XVI - Other Information

NFPA, NPCA-HMIS:		
NFPA Rating:		
Health	0	Personal Protection B
Flammability	1	
Reactivity	0	
NPCA-HMIS Rating:		
Health		Personal Protection B
Flammability		
Reactivity		

This information in this material safety data sheet should be provided to all who use, handle, store, transport, or are otherwise exposed to this product.

NOVOZYMES BIOLOGICALS, INC.
111 Kessler Mill Road
Salem, VA 24153

Telephone number: 540-389-9361 Fax: 540-389-9364

Emergency Contact: 540-389-9361 CHEMTREC: 1-800-424-9300

Material Safety Data Sheet

Date: 03/31/2006

SECTION I—PRODUCT IDENTIFICATION

NAME: –BI-CHEM[®] DC CWT Blend CAN

PRODUCT CODE - 7009848

DOT CLASS: Not Regulated.

UN NUMBER: NA

PROPER SHIPPING NAME: NA

HMIS RATING & CANADIAN WHMIS CLASSIFICATION

HEALTH	1	CANADIAN WHMIS CLASSIFICATION:	D 2 B
FIRE	0		
REACTIVITY	0		

SECTION II - INGREDIENTS

ALL COMPONENTS APPEAR ON THE TSCA INVENTORY AND CANADIAN DSL LIST. COMPONENTS NOT LISTED ARE EITHER NON HAZARDOUS OR IN CONCENTRATIONS OF LESS THAN 1%.

Ingredient Name	CAS Number	OSHA PEL	ACGIH TLV/TWA
Viable Bacterial Cultures	NA	NA	NA

SECTION III – PHYSICAL CHARACTERISTICS

Boiling Point	No Data	Appearance and Odor	Tan free flowing grain like substance, earthly odor.
Bulk Density	Approximately 0.66-0.77 gm/cm3	Melting Point	No Data
NA	6.5 - 8.5	Vapor Density	No Data
Vapor Pressure	No Data	Solubility	Minimal

NOVOZYMES BIOLOGICALS, INC.
111 Kessler Mill Road
Salem, VA 24153

Telephone number: 540-389-9361 Fax: 540-389-9364

Emergency Contact: 540-389-9361 CHEMTREC: 1-800-424-9300

SECTION IV – FIRE/EXPLOSION

Flash Point:	No data
Flash Point Method Used:	NA
LEL:	Not know
UEL:	Not known

Extinguishing Media: Water spray, carbon dioxide or dry chemical.

Special Fire Fighting Procedures: None

Unusual Fire and Explosion Hazards: None known.

SECTION V – REACTIVITY DATA

Stable: X **Unstable:**

Incompatibility: Strong acids or alkali compounds may inactivate biological cultures.

Hazardous Decomposition or By Products: Not Known.

Hazardous Polymerization: Will not occur.

SECTION VI – HEALTH HAZARD DATA

Acute Health Affects

Routes of Entry:	Inhalation: yes	Absorption: no	Ingestion: yes	Eyes: yes
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Eyes: This product may cause eye irritation.

Skin Contact: Could cause mild skin irritation after prolonged contact.

Inhalation: Inhaling dust from this product could cause irritation to the lungs and mucus membranes.

Ingestion: Ingestion of this product could cause irritation to the mouth and throat or cause choking.

Signs and Symptoms of Over Exposure: None Known

NOVOZYMES BIOLOGICALS, INC.
111 Kessler Mill Road
Salem, VA 24153

Telephone number: 540-389-9361 Fax: 540-389-9364

Emergency Contact: 540-389-9361 CHEMTREC: 1-800-424-9300

Aggravated Medical Conditions: None known, however persons with respiratory problems should avoid breathing dust from this product.

Supplemental Health Information: None

Emergency First Aid Procedures

Eye Contact: Rinse eyes with water for fifteen minutes, if irritation persists, see a physician.

Inhalation: Move person to fresh air and avoid breathing dust from product. If breathing problems develop, seek the care of a physician.

Skin Contact: Wash the product off the skin with soap and water; if irritation develops seek the care of a physician.

Ingestion: Do not induce vomiting, if victim is choking clear airway and seek medical attention.

SECTION VII – SPILL OR LEAK PROCEDURE

Steps to be taken in case material is spilled or leaked:

Waste Disposal Method: Contain and collect material, place in proper container for reuse or disposal. Dispose of materials in accordance with all federal, state and local laws.

Precautions To Be Taken In Handling and Storage: Store in a location away from children, food items and potable water.

Store in an area out of the direct sunlight, keep container closed when not in use, avoid storing in a damp environment.

Always wash hands with soap and water before handling food or smoking.

Use good chemical hygiene practices when working with any chemical.

Other Precautions: None

SECTION VIII – CONTROL MEASURES (PPE)

Respiratory Protection: Use a NIOSH approved dust mask to control nuisance dust.

Protective Gloves: Recommended. Disposable nitrile exam gloves are suitable for preventing prolonged contact with the skin.

Eye Protection: Safety glasses with side shields are recommended.

Other Protective Clothing: None required, however, avoid prolonged contact with the skin from soiled clothing.

Ventilation: Local exhaust should be sufficient. Avoid creating dust from the product. If used in a manner that creates dust, mechanical ventilation may be necessary.

NOVOZYMES BIOLOGICALS, INC.
111 Kessler Mill Road
Salem, VA 24153

Telephone number: 540-389-9361 Fax: 540-389-9364

Emergency Contact: 540-389-9361 CHEMTREC: 1-800-424-9300

The information and recommendations contained in this Material Safety Data Sheet have been compiled from sources believed to be reliable and to represent current opinion on the subject when the MSDS was prepared. No warranty, guaranty or representation is made as to the correctness or sufficiency of the information. The user of this product must decide what safety measures are necessary to safely use this product, either alone or in combination with other products, and determine its environmental regulatory compliance obligations under any applicable federal, state and local laws.

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: MicroC[®] 2000 **Publication Date:** May 31, 2015
Product Code: NA **Replaces:** February 26, 2015
Product Use: A reducing agent for biological processes

Supplier Information:

Environmental Operating Solutions, Inc Phone: 508-743-8440
160 MacArthur Blvd., Unit 6 Fax: 508-743-8443
Bourne, MA 02532 Website: www.microc.com

EMERGENCY TELEPHONE NUMBER: **CHEMTREC** **800-424-9300**

2. HAZARDS IDENTIFICATION

OSHA Regulatory Status:

This product when used as intended is not hazardous according to 29 CFR 1910.1200

Note: When vaporized, glycerin mist may cause irritation of the respiratory tract.

Potential Health Effects

Routes of Exposure	Ingestion, inhalation, skin contact, eye contact
Eyes	May cause slight irritation
Skin	May cause slight irritation
Inhalation	High mist concentrations may cause irritation of respiratory tract.
Ingestion	May be harmful if swallowed in large quantities

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS #	% by Weight
Glycerin; glycerol	56-81-5	70-74%
Water	7732-18-5	22-26%
Sodium Chloride	7647-14-5	4-6%
Methanol	67-56-1	< 1%

Safety Data Sheet

4. FIRST AID MEASURES

Eye Contact	Immediately flush eyes thoroughly with plenty of water for 15 minutes and consult a physician immediately.
Skin Contact	Remove contaminated clothing and wash affected area with water and soap. Consult physician if irritation develops
Inhalation	Remove individual to fresh air. Seek medical attention if breathing problems persist
Ingestion	Do not induce vomiting. Rinse mouth thoroughly. Seek medical attention.
General Advice	If individual feels unwell following the exposure to the product consult a physician immediately. Present this Safety Data Sheet to the doctor in attendance
Note to physician	Treat patient symptomatically

5. FIRE FIGHTING MEASURES

Flammability Summary (OSHA and NFPA)	Non-flammable Material
Protection of Firefighters:	Wear suitable protective equipment. Wear self contained breathing apparatus if necessary
Extinguishing Media	Use equipment appropriate to the main source of the fire. Water spray, alcohol foam, dry chemical or CO2. Water or alcohol foam may cause frothing
Specific hazards arising from the chemical	Carbon oxides

6. ACCIDENTAL RELEASE MEASURES

Personal Protection for Spills	Keep unnecessary personnel away from spill. Use personal protective equipment. Ventilate area of leak or spill. Avoid breathing vapors and mist.
Methods for Containment	Eliminate all sources of ignition. Stop flow of material if safe to do so. Dike spilled material. Absorb spill with inert absorbent material. Sand, earth and vermiculite are suitable absorbent materials.
Environmental Precautions	Prevent further leakage. Contain spill if safe to do so. Do not let product enter storm drains if possible.

7. HANDLING AND STORAGE

Precautions for Safe Handling	See other relevant sections of this SDS. Avoid contact with skin and eyes. Avoid breathing mist. Use with adequate ventilation. Do not handle and store near open flames, high heat or sources of ignition.
Storage	Keep containers closed when not in use. Minimize evaporative losses. Keep away from ignition sources.
Incompatible Materials for Storage	None known

Safety Data Sheet

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

INSUFFICIENT DATA ON MIXTURE. DATA ON INDIVIDUAL COMPONENTS PROVIDED BELOW

Component	Concentration in Product	ACGIH TLV	OSHA TABLE Z-1 Limits for Air Contaminants	NIOSH
Glycerin CAS No: 56-81-5	70-74% w/w	Form: Glycerin Mist TWA: 10 mg/m ³	Form: Total Dust PEL: 15 mg/m ³ Form: Respirable Fraction PEL: 5 mg/m ³	Insufficient Data on Glycerin Mist
Methanol CAS No: 67-56-1	< 1 % w/w	TWA: 260 mg/m ³	PEL: 260 mg/m ³	TWA: 260 mg/m ³

Engineering Controls

Use proper equipment and storage conditions to control airborne levels below recommended exposure limits.

Personal Protective Equipment

Eye Protection:

Use normal eye protection practices such as safety glasses with side shields. Use chemical goggles if risk of splashing is high.

Skin Protection

Handle with chemical resistant gloves. Dispose of contaminated gloves after use. Nitrile gloves recommended.

Respiratory Protection

If workers could be exposed to concentrations above the exposure limits in Section 8, use a full face respirator with multipurpose combination cartridges.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid	Flash Point	None to Boil (ASTM D93)
Color	Light brown	Boiling Point	Not determined
Odor	Musty – Sweet Odor	Evaporation Rate	Not determined
Odor Threshold	Not determined	UEL/LEL	Not determined
		Flammability (solid, gas)	Not determined
pH	4.00-11.00	Vapor Pressure	Not determined
Solubility in Water	Highly soluble in water	Vapor Density	Not determined
		Relative Density	Not Determined
Bulk Density	10.22 lbs/gal	Partition Coefficient	Not determined
Specific gravity	1.225@ 20°C	Autoignition Temperatures	
		Decomposition	
Viscosity	45 cPs @ 20C	Temperature	Not determined

Safety Data Sheet

10. STABILITY AND REACTIVITY

Reactivity	Avoid contact with oxidizing agents (e.g. nitric acid, peroxides, chromates)
Chemical Stability	Stable under normal storage conditions
Possibility of hazardous reactions	None known
Conditions to Avoid	Heat, flames, sparks. Contact with oxidizing agents
Incompatible Materials	None known
Hazardous Decomposition Products	Oxides of carbon under high heat

11. TOXICOLOGY

INSUFFICIENT DATA ON MIXTURE. DATA ON INDIVIDUAL COMPONENTS PROVIDED BELOW

Eye Contact	The components in this product may result in mild eye irritation from contact with liquid or vapors. Symptoms include redness, swelling, watering.
Skin Contact	The components in this product may result in mild skin irritation. Symptoms include redness, itching, burning, dermatitis.
Inhalation	Breathing high mist concentrations may be harmful. Inhalation can cause irritation of the throat and lungs.
Ingestion	Ingestion of this product may result in nausea, vomiting and diarrhea. Aspiration into the lungs can cause damage and inflammation to the lungs.
Target Organs	Lungs, Kidneys
Prolonged Exposure	Symptoms include nausea, headache, vomiting

Glycerin; Glycerol CAS No. 56-81-5

Acute Toxicity	Dermal LD50 = > 10,000 mg/kg (Rabbit) Inhalation LC50 = > 570 mg/m ³ 1 hr (Rat) Oral LD50 = 12,600 mg/kg (Rat)
Carcinogenicity	Not listed by ACGIH, IARC, NIOSH, NTP or OSHA
Mutagenicity	No data available
Reproductive Toxicity	No data available

Methanol 67-56-1

Acute Toxicity	Dermal LD50 = 15,800 mg/kg (Rabbit) Inhalation LC50 = 64,000 mg/m ³ 4 hr (Rat) Oral LD50 = 5,600 mg/kg (Rat)
Carcinogenicity	Not listed by ACGIH, IARC, NIOSH, NTP or OSHA
Mutagenicity	No data available
Reproductive Toxicity	No data available

Safety Data Sheet

12. ECOLOGICAL INFORMATION

Ecotoxicity	Glycerin: 96 hr LC50: 51,000-57,000 mg/L (Rainbow Trout), > 5000 mg/L Goldfish Methanol: 96 hr LC50: > 15,400-29,400 mg/L (Fish)
Persistence and degradability	No data available
Bioaccumulative potential	No data available
Mobility in soil	No data available
Other adverse effects	No data available

13. DISPOSAL CONSIDERATIONS

This product as supplied is not classified as a RCRA hazardous waste according to 40 CFR 261. However it should be fully characterized prior to disposal as contamination with other materials may subject it to hazardous waste regulations. RCRA requires the user of the product to determine whether the product meets RCRA criteria for hazardous waste. Always consult with local, state and federal regulations prior to disposal.

14. TRANSPORTATION INFORMATION

US Domestic DOT	Not Regulated
Shipping Name	Glycerin; Glycerol
IMDG	Not dangerous goods
IATA	Not dangerous goods
Marine pollutant	No

15. REGULATORY INFORMATION

United States

Toxic Substances Control Act

The components of this product are listed on the TSCA Inventory of Existing Chemical Substances

Section 302 (EHS) TPQ	Not applicable
Section 304 (EHS) TPQ	Not applicable

SARA Section 311/312 Hazard Categories

Acute - NO
Chronic - NO
Physical - None
Pressure Hazard - NO
Fire Hazard - NO

Safety Data Sheet

SARA Section 313

This product may contain trace amounts of a chemical that is subject to reporting requirements of SARA

Methanol CAS # 67-56-1 Typical % Weight in Product 0.0-0.10%

CERCLA

This product may contain trace amounts of a chemical that is subject to reporting requirements of CERCLA

Methanol RQ # 5,000. Typical % Weight in Product 0.0-0.10%

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3): None

State Right to Know Regulations

Chemical Name: Glycerin

California – Proposition 65 Not applicable

Massachusetts Right to Know Glycerin

Minnesota Hazardous Substances List Glycerin mist

New Jersey Right to Know None

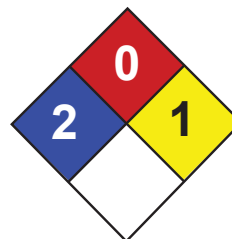
Pennsylvania Right to Know Glycerin

Rhode Island Right to Know Glycerin

16. ADDITIONAL INFORMATION

MSDS REVISION STATUS: May 31, 2015 | Replaces February 26, 2015

THIS MATERIAL SAFETY DATA SHEET (MSDS) HAS BEEN PREPARED IN COMPLIANCE WITH THE FEDERAL OSHA HAZARD COMMUNICATION STANDARD, 29 CFR 1910.1200. THE INFORMATION IN THIS MSDS SHOULD BE PROVIDED TO ALL WHO WILL USE, HANDLE, STORE, TRANSPORT, OR OTHERWISE BE EXPOSED TO THIS PRODUCT. WE BELIEVE THIS INFORMATION TO BE RELIABLE AND UP TO DATE AS OF ITS PUBLICATION DATE, BUT MAKE NO WARRANTY THAT IT IS. IF THIS MSDS IS MORE THAN THREE YEARS OLD YOU SHOULD CONTACT THE SUPPLIER TO MAKE CERTAIN THAT THE INFORMATION IS CURRENT.



Health	2
Fire	0
Reactivity	1
Personal Protection	E

Material Safety Data Sheet

Sodium carbonate MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium carbonate

Catalog Codes: SLS3481, SLS1264, SLS4105, SLS1894, SLS3316

CAS#: 497-19-8

RTECS: VZ4050000

TSCA: TSCA 8(b) inventory: Sodium carbonate

CI#: Not available.

Synonym: Crystal Carbonate, Disodium Carbonate, Sal Soda, Soda Asha, Washing Soda

Chemical Name: Sodium Carbonate, Anhydrous

Chemical Formula: Na₂-C-O₃

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium carbonate	497-19-8	100

Toxicological Data on Ingredients: Sodium carbonate: ORAL (LD₅₀): Acute: 4090 mg/kg [Rat]. 6600 mg/kg [Mouse]. DUST (LC₅₀): Acute: 2300 mg/m³ 2 hours [Rat]. 1200 mg/m³ 2 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation (lung irritant).

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to upper respiratory tract, skin, eyes. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Emits Na₂O fumes when heated to decomposition.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:

Sodium carbonate can ignite and burn fiercely in contact with fluoride. Sodium Carbonate in contact with fluorine decomposed at ordinary temperature with incandescence.

Special Remarks on Explosion Hazards:

Reacts explosively with red-hot aluminum metal. Sodium carbonate + ammonia in arabic gum solution will explode.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. If necessary: Neutralize the residue with a dilute solution of acetic acid. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Neutralize the residue with a dilute solution of acetic acid. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:

Do not ingest. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as acids.

Storage:

Hygroscopic. Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 24°C (75.2°F).
Hygroscopic

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Solid powder.)

Odor: Odorless.

Taste: Alkaline.

Molecular Weight: 105.99 g/mole

Color: White.

pH (1% soln/water): 11.5 [Basic.]

Boiling Point: Not available.

Melting Point: 851°C (1563.8°F)

Critical Temperature: Not available.

Specific Gravity: Density: 2.532 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility:

Soluble in hot water, glycerol. Partially soluble in cold water. Insoluble in acetone, alcohol.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, moisture

Incompatibility with various substances:

Reactive with acids. Slightly reactive to reactive with moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Hygroscopic. Combines with water with evolution of heat. Incompatible with phosphorus pentoxide, lithium, fluorine, fluoride, ammonia + silver nitrate, 2,4,6-trinitrotoluene, ammonia, acids, sodium sulfide + water, hydrogen peroxide, red hot aluminium metal, sodium sulfide, zinc, calcium hydroxide. Sodium Carbonate is decomposed by acids with effervescence. Reacts violently with F₂, Lithium, and 2,4,6-trinitrotoluene. Sodium begins to decompose at 400 C to evolve CO₂.

Special Remarks on Corrosivity: Hot concentrated solutions of sodium carbonate are mildly corrosive to steel.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC₅₀ VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD₅₀): 4090 mg/kg [Rat]. Acute toxicity of the dust (LC₅₀): 1200 mg/m³ 2 hours [Mouse].

Chronic Effects on Humans: May cause damage to the following organs: upper respiratory tract, skin, eyes.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant), of ingestion, of inhalation (lung irritant).

Special Remarks on Toxicity to Animals: LDL (Lowest Published Lethal Dose) [Man] - Route: Oral; Dose: 714 mg/kg

Special Remarks on Chronic Effects on Humans: May cause adverse reproductive effects based on animal test data

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Causes skin irritation with possible burns depending on the concentration, site (abraded or intact skin), and duration of exposure. Eyes: Causes eye irritation and possible burns. Concentrated solutions may cause permanent corneal injury (permanent corneal opacity). Ingestion: Sodium carbonate ingestion may cause irritation of the digestive tract resulting in nausea, vomiting, diarrhea, thirst, abdominal pain depending on concentration and amount ingested. May also affect the cardiovascular system. Inhalation: Dust may cause respiratory tract and mucous membrane irritation with coughing and shortness of breath (dyspnea), pulmonary edema. Chronic Potential Health Effects: Chronic inhalation may result in decreased pulmonary function, nasal congestion, nosebleeds, perforation of the nasal septum. Other effects of chronic exposure are skin (dermatitis and ulceration), and gastrointestinal complaints. However, the effects of chronic exposure seem to be reversible if exposure is decreased.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD₅ and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: TSCA 8(b) inventory: Sodium carbonate

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R36/37/38- Irritating to eyes, respiratory system and skin. S22- Do not breathe dust. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 1

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:26 PM

Last Updated: 05/21/2013 12:00 PM

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APPENDIX G

GLOSSARY & TERMS

Glossary & Terms

The following section defines abbreviations and technical terms used within this manual and the wastewater treatment industry in general.

1. ACRONYMS & ABBREVIATIONS

ACRONYM	DEFINITION
AT	Aeration Tank
BOD	Biological Chemical Oxygen Demand
cBOD	Carbonaceous Biological Oxygen Demand
CaCO₃	Calcium Carbonate
CIP	Clean In Place
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
<i>E-Coli</i>	Escherichia coli - Gram-negative, rod-shaped bacterium
EQ	Equalization Tank
FOG	Fat, Oil and Grease
kPa	Kilo Pascal
L	Liter
LMH	Liters / m ² of Membrane Area per Hour (Flux)
MBR	Membrane Bioreactor
MLSS	Mixed Liquor Suspended Solids
MLVSS	Mixed Liquor Volatile Suspended Solids
MT	Membrane Tank
NaOCl	Sodium Hypochlorite
NaOH	Sodium Hydroxide
NH₃ -N	Ammonia as Nitrogen (unionized)
NH₄ -N	Ammonium as Nitrogen (ionized)
NO₃ -N	Nitrate Nitrogen

ACRONYM	DEFINITION
NO₂ -N	Nitrite Nitrogen
NTU	Nephelometric Turbidity Unit
O₂	Molecular Oxygen
OUR	Oxygen Uptake Rate
PC	Primary Clarifier
P&ID	Process and Instrumentation Diagram
pH	Measure of Acidity & Alkalinity
PLC	Programmable Logic Controller
ppb	parts per billion
ppm	parts per million
psi	pounds per square inch
PSL	Pressure Switch Low
RAS	Return Activated Sludge
SDI	Silt Density Index
TP	Total Phosphorus
TMP	Transmembrane Pressure
TKN	Total Kjeldahl Nitrogen
TN	Total Nitrogen
TDS	Total Dissolved Solids
TS	Total Solids
TSS	Total Suspended Solids
VFD	Variable Frequency Drive
VSS	Volatile Suspended Solids
UF	Ultrafiltration
UV	Ultraviolet
WAS	Waste Activated Sludge
WWTP	Waste Water Treatment Plant

2. TECHNICAL TERMS DEFINITION

ACID	Substance which solution has a pH below 7.0, sour taste, releases hydroxyl ions in water and reacts with bases.
ACTIVATED SLUDGE	The floc produced in wastewater due to the growth of bacteria and other organisms in the presence of dissolved oxygen.
ACTIVATED SLUDGE PROCESS	Activated sludge is a process for treating sewage and industrial wastewaters using air and a biological floc composed of bacteria and protozoa.
ACTUATED VALVE	Valve with an actuator that is controlled by an external command.
ADVANCED WASTEWATER TREATMENT	Process designed to produce an effluent of higher quality than normally achieved by secondary treatment processes.
AEROBIC	Life or processes that require, or are not destroyed by, the presence of free elemental oxygen.
AEROBIC BACTERIA	Bacteria that require the presence of oxygen to live and grow.
AEROBIC DIGESTION	The aerobic digestion process is a treatment process that utilizes aerobic microbes to stabilize the solids. The microbes digest solids from primary sedimentation processes, and those from secondary treatment processes. Due to the length of time that the solids remain under aeration, the long solids retention time allows for the microbes to feed off of the cell contents of other dying/decaying microbes under digestion. This is referred to as "endogenous respiration" or "endogenous stabilization." There will be an "inert fraction" between 20 and 25% by weight, in the resulting stabilized solids. This inert fraction will consist of fine inorganic solids, organic solids, and cell components that will not be degradable by

AEROBIC ZONE

An environment where there is dissolved air or free oxygen.

AIR DIAPHRAGM METERING PUMP

Air diaphragm metering pump provides chemical dosing at measured rates. The dosing is set manually and it is regulated either by the amount of compressed air driving the pump or by setting the backpressure of the pumps.

AIR FLOW SWITCH (PSL)

Located on the supplemental aeration piping, used to indicate when a specific flow rate has been reached for a blower. This flow rate identifies low aeration to the aeration or membrane tank, triggering an alarm or alert.

AIR SCOURING

Diffusers placed below the membrane modules generate air bubbles in water that scour (rub) the membrane surface and keep it clean.

ALARM

A visible or audible indication of abnormal situation. An alarm may be an operator interface screen message, a light, a buzzer or another form of communication to the operator.

ALKALINE

A solution having an excess of hydroxyl (OH) ions - with pH greater than 7.0.

ALKALINITY

The capacity of water or wastewater for neutralizing an acid. Alkalinity in wastewater results from the presence of carbonate, bicarbonate, and hydroxide. Alkalinity in water helps to resist changes in pH caused by addition of acids. Generally expressed as an amount of CaCO₃ equivalent.

ANAEROBIC

Life or processes that require, or are not destroyed by, the absence of free elemental oxygen.

ANAEROBIC BACTERIA

Any bacteria that can survive in partial or complete absence of oxygen by using molecular oxygen found in

nitrates and sulfates.

ANAEROBIC BIOLOGICAL REACTOR

Anaerobic (in the absence of oxygen) decomposition breaks down large molecules into small molecules increasing the rate of methane generation, which can be used for energy recovery.

ANALOG

An electrical signal that is proportional to the size of the variable being monitored or controlled.

ANOXIC

Conditions where some species other than oxygen acts as the electron donor for biochemical reactions.

AUTOMATIC FLOW VALVE

This valve is used when regular changes are required in the state of the valve (fully open or fully closed only). It is controlled by the PLC.

**BACKPULSE / BACKFLUSH /
BACKWASH**

A mode of operation in which the flow of permeate is reversed through the membrane. During backwash, accumulated solids go away from the membrane surface due to the combined effects of the membrane air scouring and backwash of permeate.

**BIOCHEMICAL (BIOLOGICAL) OXYGEN
DEMAND**

A measure of the amount of oxygen consumed in the biological process breaking down organic matter in water – the greater the BOD, the greater the degree of pollution.

BIOCIDE

A chemical for preventing biological growth.

**BIOLOGICAL TREATMENT (or
BIOTREATMENT)**

Process whereby dissolved organic chemical constituents are removed through biodegradation.

BIOMASS

The mixture of biodegradable material, bacteria, and biosolids present in a biological wastewater treatment system.

BIOSOLIDS

Material from sludge treatment, which contains organic matter and plant nutrient; unlike excess waste activated sludge, biosolids have undergone a treatment to decrease or eliminate pathogenic organisms. Biosolids

can be beneficially recycled.

BLOWER

Blowers are used to introduce air in order to create an aerobic environment for BOD removal and for scouring the membranes to prevent membrane fouling.

MODULE (for newterra MicroClear® MBR)

Membrane filtration unit; it is a group of interlocked MicroClear® cassettes, fastened together to act as a single unit.

CHEMICAL OXYGEN DEMAND

A test used to estimate the amount of organic matter within a sample using a strong chemical oxidizing agent. The COD is generally higher than the BOD (for sewage BOD / COD ratio varies from 0.4 to 0.8).

COAGULANT

An agent that causes fine or suspended impurities to group together (coagulate).

COMBINED SEWER

A sewer system that carries both sanitary sewage and stormwater (SW) runoff.

CONDITIONING FOULING

First stage of membrane fouling through adsorption of material.

CONTAMINANT

A source of contamination, an impurity and any substance in water which is not H₂O.

CRITICAL FLUX

Flux below which permeability decline is considered negligible.

DENITRIFICATION

Biochemical reduction of nitrate to nitrogen gas.

EFFLUENT

Wastewater – treated or untreated – that flows out of a treatment plant, sewer, or industrial outfall.

ELECTRON DONOR

Species capable of donating an electron to a suitable

acceptor and is oxidized as a result.

EQUALIZATION TANK	Used for equalization of flow and composition of wastewater.
F/M (RATIO)	Food-to-microorganism ratio (F/M) – rate at which substrate is fed to the biomass compared to the mass of biomass solids.
FEED	Feed is the term use to define fluid entering a membrane module or wastewater treatment plant.
FILTER CAKE	Accumulated particles on a filter surface.
FILTRATE	Portion of the feed stream which has passed through a filter; also known as “permeate” in membrane system.
FLOC	Aggregated solid (biomass) particle.
FLUX (or PERMEATE VELOCITY)	Quantity of material (water) passing through an area of membrane per unit time – usually expresses LMH (L/m ² .h), or gfd (gal/ft ² .d).
FOULING	Processes leading to deterioration of flux due to surface or internal blockage of the membrane.
GLYCERIN	Glycerin is the commercial form of glycerol. It is used for membrane long term preservation to avoid membrane drying.
HOUSING	Vessel which holds a membrane module.
HYDRAULIC LOADING RATE	Rate at which water enters the reactor.

HYDRAULIC RETENTION TIME (HRT)

The time required to displace the working volume of a bioreactor. $HRT (d) = \text{Bioreactor volume (L)} / \text{Feed flow rate (L/d)}$.

INFILTRATION

Entry of water into a sewer system from sources other than infiltration – such as defective pipes, pipe joints, connections, or manhole walls.

INFLOW

Entry of water into a sewer system through such sources as defective pipes, pipe joints, connections, or manhole walls.

INPUTS / OUTPUTS

Inputs / Outputs refer to the direction of the electronic signal in reference to the PLC. They can be either digital or analog signals.

INTENSIVE / RECOVERY CLEAN

Cleaning with aggressive chemicals to recover membrane permeability.

IRREVERSIBLE / PERMANENT FOULING

Not removed by physical cleaning but removed by chemical cleaning.

LAND APPLICATION

Treatment or disposal of wastewater or wastewater solids by spending it on land under controlled conditions.

LEVEL SWITCH

Level switches are placed in tanks to indicate water level.

MICROORGANISMS

Microscopic organisms, either plant or animal, invisible or barely visible to the naked eye. Examples: algae, bacteria, fungi, protozoa, and viruses.

MAINTENANCE CLEANING

Cleaning with less aggressive chemicals to maintain membrane permeability.

MEMBRANE

A porous synthetic material which acts as a highly efficient barrier or filter in the range of molecular dimensions – allowing passage of ions, water and other solvents, and very small molecules – but most impermeable to macromolecules. Membrane classes include – MF (microfiltration), UF (ultrafiltration), NF (nanofiltration), RO (reverse osmosis).

MEMBRANE BIOREACTOR	A biological wastewater treatment system that uses a membrane to separate water from biomass.
MEMBRANE CONFIGURATION	In membrane separation technology, configuration of a membrane product describes its construction or membrane spatial arrangement. Basic membrane configurations include hollow fiber, spiral, tubular, and flat-sheet.
MEMBRANE PACKING DENSITY	Membrane area per unit volume.
MEMBRANE TANK / BASIN	Tank/basin wherein membrane cassettes are placed.
MESOPHILIC	Thriving at intermediate temperatures: 20 to 45 °C (15 °C optimum).
MESOPORE	Pore with diameter between 2 and 50 µm.
METHANOGENS	Microorganisms producing methane as a metabolic byproduct.
MICROFILTRATION (MF)	A process using a membrane class to separate relatively large particles – 0.1 to 3 µm in diameter, with relatively low applied pressures. In crossflow microfiltration system, feed solution flows perpendicular to the filter surface.
MIXED LIQUOR SUSPENDED SOLIDS (MLSS, mg/L)	A measure of the quantity of suspended solids in the aeration tank of an activated sludge treatment system.
MIXED LIQUOR VOLATILE SUSPENDED SOLIDS (MLVSS, mg/L)	The portion of MLSS that vaporizes when heated to 550°C (1022° F).
MODULE (membrane)	Smallest practical unit containing one or more membranes and supporting structures.

NITRIFICATION

Biochemical oxidation of ammonia to nitrate.

NUTRIENTS

Any substance that is assimilated by organisms and promotes growth; generally applied to nitrogen and phosphorus in wastewater, but also applied to other essential and trace elements.

OPERATION AND MAINTENANCE (O&M)

Organized procedure for causing a piece of equipment or a treatment plant to perform its intended functions and for keeping the equipment or plant in such a condition that it is able to continually and reliably perform its intended function.

(ORGANIC) LOADING RATE

Rate at which (organic) matter is introduced into the reactor.

PERMEABLE

Porous to the passage or penetration by fluids.

PERMEABILITY

The ratio of the flux and transmembrane pressure at that flux ($L/m^2 / h / kPa$ or gfd/psi).

PERMEATE

Water or fluid which has passed through the membrane; also referred to as "filtrate".

PERMEATE PUMP

Vacuum pump which draws permeate through the membrane, as in MBR.

PERMIT

A legal document issued by the government agency. In wastewater treatment, a discharge permit requires that the plant operator achieve specific water quality standards and discharge limits by a certain date, and also establishes monitoring and reporting requirements.

PLATE-AND-FRAME

Synonymous with "flat-sheet".

PLUG FLOW

Flow in which no back-mixing or dispersion occurs along the length of the pipe or reactor.

POLLUTANT	A contaminant at high enough concentration to endanger the aquatic environment or public health.
PORE	An opening in a membrane or filter matrix.
POROUS	Ability of certain substances to pass fluids due to an open physical structure.
POROUS PLUGGING	Type of membrane fouling – due to pore blockage.
POROUS MEMBRANE	Membrane of low selectivity operating by physical straining alone.
PRETREATMENT	In membrane wastewater treatment systems, pretreatment is the initial processing of wastewater to prolong the life of a membrane system and to optimize membrane performance. Pretreatment includes screening, equalization, oil & grease removal, primary clarification, aeration to oxidize colloidal and dissolved organics in wastewater.
RECEIVING STREAM	A river, lake, ocean, or other water course into which wastewater or treated effluent is discharged.
RELAXATION	Ceasing permeation whilst continuing to scour the membrane with air bubbles.
RESISTANCE	Resistance to flow – proportional to flow rate-to-pressure ratio.
RETENTATE	Water or fluid which is rejected by the membrane – portion of the feed solution in UF and RO that does not pass through the membrane; also called “concentrate” or “reject”.
REVERSIBLE OR TEMPORARY FOULING	Gross solids attached to the membrane surface and which can be removed by physical cleaning relatively easily – such as backflushing or relaxation.

SANITARY SEWER	A sewerage system that carries only household and commercial wastewater / sewage.
SCALING	Buildup of precipitated salts on a surface – such as pipes, tanks, boiler tubes, membrane surface (in RO, UF) resulting in a physical or chemical change.
SECONDARY TREATMENT - CONVENTIONAL	Generally, a level of treatment that produces removal efficiencies of 85 percent for BOD and suspended solids – sometimes used interchangeably with the concept of biological wastewater treatment, where wastewater is mixed with air or oxygen and sludge to encourage the growth of bacteria that “eat” organic pollutants.
SEWER	An artificial, usually subterranean conduit, used to carry off sewage or wastewater.
SILT DENSITY INDEX (SDI)	A test used to measure the level of suspended solids in feed water (especially for RO). It is a measure of the tendency of water to foul a membrane, based on a timed flow through a membrane filter (0.45 µm), at a constant pressure, also known as “fouling index”.
SHEAR (STRESS)	Force applied to a body which tends to produce a change in its shape, but not its volume.
SIDE-STREAM	Stream outside the bioreactor.
STACK	Smallest practical unit containing one or more membranes and supporting structures.
SUBSTRATE	Surface or medium on which an organism grows or is attached.
SUPERNATANT	Liquid clarified by sedimentation.

SURFACE POROSITY	Percentage of the surface area occupied by the pores.
SUSPENDED SOLIDS	Solid pollutants that either float on the surface of, or are suspended in, wastewater.
SUSTAINABLE FLUX	Flux for which the TMP (transmembrane pressure) increases gradually at an acceptable rate, such that chemical cleaning is not necessary.
THERMOPHILIC	Thriving at relatively high temperatures (49- 57 °C (45 °C optimum).
TOTAL SOLIDS	Total dissolved and undissolved solids in water or wastewater.
TRANSMEMBRANE PRESSURE	Pressure difference from the feed side of the membrane to the permeate side.
TURBIDITY	A suspension of fine particles in water that obscure the light rays and cause cloudiness and will not readily settle due to small particle size. Measure of the clarity of an otherwise clean liquid – cloudy or hazy appearance in a naturally clear liquid. Typically, turbidity of the MBR permeate is less than 1 N.T.U.
TURBIDITY UNITS	Measurement of relative ability of a solution to allow a light beam to pass through it; usual units are N.T.U. (Nephelometric Turbidity Units).
ULTRAFILTER	A mechanical unit used in the membrane separation process.
ULTRAFILTRATE	A synonym for UF “permeate”.

ULTRAFILTRATION (UF)

Membrane separation process based on size exclusion. UF operates in the molecular weight cut-off (MWCO) range from 1,000 MWCO to 200,000 MWCO, or 0.002 μm to 0.1 μm . Emulsified oils, suspended solids, bacteria, and large molecules are rejected by UF membranes. Water and small molecules – dyes, surfactants, dissolved salts, and solvents pass through in the permeate.

VOLUMETRIC MASS TRANSFER COEFFICIENT

A combination of the overall liquid mass transfer coefficient and the specific area for mass transfer. The term measures the mass transfer of oxygen into the liquid via air bubbles.

WASTEWATER

Spent or used water from a community or industry that contains dissolved and/or suspended matter.

α or β FACTOR

Factors applied to correct biological aeration demand for dissolved and suspended solids content of biomass.

APPENDIX

Biological Treatment & Monitoring Parameters

Biological Treatment and Monitoring Parameters

This section offers the introduction of some key terms for biological control and wastewater quality description. It is important that the operators become familiar with how these parameters are obtained and what each of these terms mean and how each relates to the MBR wastewater treatment process operation.

1. Removal of substrates in wastewater

Carbonaceous pollutants removal

The concept of carbonaceous pollutants treatment is very simple. The bacteria remove small organic carbon molecules by 'eating' them. As a result, the bacteria grow, and the wastewater is cleaned. Although there are many thousands of chemical reactions involved in the metabolism of a bacterium, three major processes that are relevant to the biological treatment of sewage are ingestion, respiration, and growth and division.

Some of organic carbons go along the pathway of catabolism or respiration and end up as carbon dioxide, and they are lost to the system. The remaining organic carbons follow the anabolism or growth pathway and end up in new biomass, and these carbons are therefore retained in the system. The purpose of respiration is also to provide the energy that is required for growth and for the maintenance of the bacterium.

These three processes of ingestion, respiration and growth are very highly coupled or meshed. No one process can go faster than the other. One implication of this is that, for instance, if you measure the respiration rate, you are indirectly also measuring the rate of growth and the rate of carbon ingestion.

Growth is the driver and rate-limiting step. Every bacterium has a genetically programmed maximum rate of growth that will be achieved under ideal conditions. As it grows, it withdraws carbon compounds from the internal pool in its cytoplasm. Carbon flows in from the mixed liquor in order to keep this pool topped up. At the same time, energy is used for biosynthesis and growth, and hence the catabolism pathways of respiration also withdraw carbon from the internal pool, and this also results in carbon being drawn in by ingestion.

The three processes correspond to the major processes that we shall see when we examine the operation of the treatment works in aeration basin. Ingestion, respiration and growth and division correspond to biodegradation, aeration requirement and biomass production respectively.

Whilst the concept is very simple, the control of the treatment process is very complex, because of the large number of variables that can affect it. Whilst the major substrate requirement is for carbon growth is also dependent on the intake of nitrogen and phosphorus. The optimum ratio of C:N:P in the mixed liquor is generally thought to be 100:5:1. Trace components, which include S, Na, Ca, Mg, K, and Fe are also required, and are available in abundance in domestic sewage. By contrast, the wastewater from brewing, pulp and paper, and food-processing industries can be deficient in nitrogen and phosphorus. Nutrients therefore need to be added to the mixed liquor to obtain maximum bacterial growth and to optimise carbonaceous treatment. From an operational point of view, lack or an insufficiency of a critical nutrient may result in incomplete treatment, because the bacteria are unable to grow optimally.

Growth can be inhibited, if oxygen concentration falls to very low levels in the aeration tank. This is because oxygen becomes limiting for respiration. Dissolved Oxygen (DO) is not limiting above concentrations of about 1.0 – 2.0 mg/L for bacteria in flocs and about 0.6 mg/L for dispersed bacteria. Below these critical concentrations, the respiration rate falls rapidly due to the unavailability of oxygen. Filamentous bacteria have a greater tolerance of low oxygen levels than floc bacteria. At DO concentrations below the critical concentration, filamentous bulking can occur, as their relative biomass increases.

Bacteria have a genetically determined viable temperature range. For most carbonaceous bacteria of the activated sludge, this is from about 0 to 35°C. However thermophilic bacteria survive and grow between about 35°C and 60°C. In general, growth rate follows the rule of Arrhenius that chemical reactions double in rate for a 10°C increase in temperature. Thus as the temperature increases, the rate of growth, and hence requirement of oxygen for respiration, increases.

Toxic chemicals in the wastewater can enter the bacteria and inhibit one or more enzymes of the pathways involved in either anabolism or catabolism. If the catabolic reactions of respiration are affected, the rate of respiration and energy production is reduced and the rate of growth is therefore reduced. On the other hand, if the anabolic pathways of biosynthesis are inhibited, the rate of growth is reduced, and this is accompanied by a fall in the rate of respiration, as the requirement for energy is reduced. In the aeration tank, toxicity has the effect of reducing the rate at which organic carbon is degraded. This can be easily monitored by observing changes in the rate of respiration of the activated sludge.

Ammonia removal by nitrification

The ammonia ($\text{NH}_4\text{-N}$) removal is achieved by biological nitrification process. Biological nitrification is an aerobic process of conversion of ammonia to nitrite ($\text{NO}_2\text{-N}$) and then to nitrate ($\text{NO}_3\text{-N}$). Because of the low growth rate and poor cell yield of nitrifying bacteria, nitrification is generally a rate-limiting step in biological nitrogen removal process. The key requirement for nitrification to occur is that the net rate of accumulation of biomass (and hence the net rate of withdrawal of biomass from the system) is less than the growth rate of nitrifying bacteria. Long sludge retention time (SRT) used in MBR system ensures near complete nitrification with an effluent $\text{NH}_4\text{-N}$ concentration of less than 1 mg/L (as long as influent wastewater characteristics stays within the design range).

Nitrification is affected by a number of environmental factors including pH, temperature, DO concentration, and toxicity. Nitrification is pH sensitive. A pH of 7.0 to 7.2 is normally used to maintain reasonable nitrification rates, with optimal rate occur at pH of 7.5 to 8.0. Alkalinity addition is required, if deficient, to maintain the proper operating pH range. Nitrifiers are much more sensitive to temperature than heterotrophic bacteria. To ensure sufficient nitrification, it is recommended that the MBR unit is operated at a temperature of greater than 15°C. Nitrification rate is also affected by DO level. Nitrifiers are strict aerobes, and thus the reaction rate is susceptible to inhibition at very low DO levels. A DO of 1 mg/L is considered as a minimum requirement to prevent any rate inhibition caused by insufficient DO level. No impact on nitrifiers growth rate is evident when the DO level is greater than 2 mg/L. Toxicity is typically not of concern for camp type wastewater, unless quat ammonia is being used as a disinfectant agent in the camp. Nitrification can easily be restored if non quat based disinfectant is being used.

Total nitrogen removal by nitrification/denitrification

Biological nitrification/denitrification is a two-step process. The first step is nitrification, which is conversion of $\text{NH}_4\text{-N}$ to $\text{NO}_3\text{-N}$ through the action of nitrifying bacteria. The second step is nitrate conversion (denitrification), which is carried out by facultative heterotrophic bacteria under anoxic conditions. In denitrification, nitrate serves as the electron acceptor in energy metabolism and is converted to various gaseous end products but principally molecular nitrogen, N_2 , which is then stripped from the liquid stream.

Denitrification or reduction of nitrate to nitrogen gas under anoxic conditions depends on nitrate being produced in the nitrification process under aerobic conditions. For total nitrogen removal, first nitrification and then denitrification should occur efficiently to achieve the desired effluent quality. Denitrification releases nitrogen which escapes as an inert gas to the atmosphere while oxygen released stays dissolved in the liquid and thus reduces the overall oxygen requirement of the process. Denitrification also returns part of the alkalinity consumed during nitrification. Thus where feasible, denitrification can be incorporated to reduce energy cost and external alkalinity addition.

The heterotrophic bacteria that perform denitrification are typically less sensitive to inhibition from toxic chemicals compared to nitrifiers. However, toxicity is still a concern. Oxygen has been found to inhibit nitrate reduction by repressing the nitrate reduction enzyme, slowing the rate of nitrite reduction. A carbon source is also essential as electron donor for denitrification to take place. This source may be in the form of carbon internally available in sewage or artificially added (eg. as methanol). Typically, if influent BOD/TKN or COD/TKN is higher than 5 or 10, assuming COD/BOD ratio of 2, MBR treatment can meet stringent effluent total nitrogen requirement (i.e., < 5mg/L) without providing supplemental carbon.

Temperature has a significant influence on maximum growth rate of denitrifying population, and the maximum growth rate of denitrification roughly doubles for every 10°C increase in temperature between 5 and 25°C. The denitrification rate is strongly affected by the kinetic regime of the reactor. Plug-flow reactors and reactors in series will produce higher denitrification rates. This typically will happen when the availability of substrate limits the denitrification reaction. In contrast to nitrifying organisms, there has been less concern about pH influences on denitrification rates. Also, no significant effect on the denitrification rate has been reported for pH from 7.0 to 8.0.

Phosphorus removal

Phosphorus removal from wastewater can take place by biological or chemical methods. For each treatment method, the plant-layout and operation will be different and the consumption of energy and chemicals may be quite different.

The chemical phosphorus (P) removal relies on the transformation of soluble phosphorus to a particle form, which is then by solid-liquid separation processes, such as membrane separation. This reaction is deceptively simple and must be considered in light of the many competing reactions and their associated equilibrium constants and the effects of alkalinity, pH, trace elements found in wastewater. The overall chemical (usually lime, alum, iron and PAC) dose requirement for phosphorus removal depends on the phosphorus limit required in the permit and the design features of the treatment plant. An important operation parameter is the observed added chemical dose to the removed orthophosphate molar ratio for a plant. This parameter varies depending on the type of processes used for removing orthophosphate and particulate phosphate and the total phosphorus (TP) and orthophosphate residual required to attain permit limit. Dosages are generally established on the basis of bench-scale tests and occasionally by full-scale tests, especially if polymers are used. Typically, as the orthophosphate residuals decreased, the molar ratio of coagulant added to phosphorus removed increases.

In the biological phosphorus removal, the main actors are the polyphosphate accumulating organisms (PAOs) who take up large amounts of phosphorus from phosphates by exposing

them to alternating anaerobic and anoxic/aerobic conditions, and phosphorus is subsequently removed from the process as a result of sludge wasting.

2. Monitoring parameters

Biochemical Oxygen Demand (BOD)

One of the most commonly measured constituents of wastewater is the biochemical oxygen demand, or BOD. Wastewater is composed of a variety of inorganic and organic substances. Organic substances refer to molecules that are based on carbon and include fecal matter as well as detergents, soaps, fats, greases and food particles. These large organic molecules are easily decomposed by bacteria. However, oxygen is required for this process of breaking large molecules into smaller molecules and eventually into carbon dioxide and water. The amount of oxygen required for this process is known as the BOD. The Five-day BOD or BOD₅ is determined by incubating a sealed sample of wastewater for five days and measuring the loss of oxygen from the beginning to the end of the test.

The main focus of wastewater treatment plants is to reduce the BOD in the effluent discharged to natural waters. If effluent with high BOD levels is discharged into a stream or river, it will accelerate bacterial growth and consume the oxygen levels in the river. The oxygen may diminish to levels that are lethal for most fish and many aquatic insects.

Chemical Oxygen Demand (COD)

COD is the oxygen equivalent of organic material in wastewater that can be chemically oxidized using dichromate in an acid solution. COD does not differentiate between biologically available and inert organic matter, and it is a measure of the total quantity of oxygen required to oxidize all organic material into carbon dioxide and water. And, some inorganic substances that are oxidized by the dichromate will increase the apparent organic content of the wastewater sample. COD values are always greater than BOD values and overestimate the carbon that can be removed by the activated sludge, but COD measurements can be made in a few hours while BOD₅ measurements take five days.

Total Suspended Solids (TSS)

Wastewater usually contains large quantities of suspended solids that are organic and inorganic in nature. TSS is a laboratory measurement of the quantity of suspended solids present in wastewater, and it is determined by filtering a well-mixed sample through a weighed standard glass-fiber filter and the residue retained on the filter is dried to a constant weight at 103 to 105°C. The increase in weight of the filter represents the total suspended solids. TSS includes

the total suspended particulate matter, both inert and volatile, but does not include dissolved solids.

TSS is one of the two universally used effluent standards (along with BOD) by which the performance of treatment plants is judged for regulatory control purposes. As levels of TSS increase, a water body begins to lose its ability to support a diversity of aquatic life, because suspended solids can cause the increase of water temperature and decrease of dissolved oxygen and photosynthesis, and it also harm fish directly by clogging gills, reducing growth rates, and lowering resistance to disease.

Volatile Suspended Solids (VSS)

VSS is a measure of the volatile portion of the TSS (the volatile portion which burns off at 550°C). VSS is usually interpreted as an accurate estimate of the microbial or organic portion of TSS. VSS is determined from laboratory analysis of TSS samples.

Total Dissolved Solids (TDS)

TDS is a measurement of the total solids in the filtrate after filtering a wastewater sample.

Mixed Liquor Suspended Solids (MLSS)

MLSS is a measurement of the solids particulate matter (i.e., the TSS concentration) in a sample collected from the aeration or membrane tanks. The MLSS concentration result is used to determine when and how much sludge is to be wasted from the system. The initial target MLSS concentration is 10,000 mg/L.

Mixed Liquor Volatile Suspended Solids (MLVSS)

MLVSS is a measurement of the concentration of the volatile portion of the MLSS. MLVSS is interpreted as an approximate estimate of the microbial or organic portion of MLSS.

Turbidity

Turbidity is another indicator of the amount of material suspended in water, and it measures the amount of light that is scattered or absorbed. Photoelectric turbidimeters measure turbidity in nephelometric turbidity units (NTUs). Turbidity units are supposed to correspond to TSS concentrations, but this correlation is only approximate.

Nitrogen

Nitrogen compounds are of interest to wastewater treatment plant operators because of the importance of nitrogen in the life cycles of plants and animals. Nitrogen is a nutrient and occurs in many forms including ammonia, organic, nitrate and nitrite each of which may be tested for in a variety of ways. Raw domestic wastewater nitrogen is normally present in the organic nitrogen and ammonia forms, with small quantities of the nitrite and nitrate forms. Depending on the amount of nitrification which occurs within the plant, the effluent may contain either ammonia or nitrate nitrogen. Under normal circumstances, the nitrite form of nitrogen will not be present in large quantities due to its rapid oxidation or conversion to nitrate.

Ammonia nitrogen ($\text{NH}_4\text{-N}$) occurs partly in the form of ammonium ions (NH_4^+) and partly as ammonia (NH_3). Ammonia and organic forms of nitrogen are often measured as Total Kjeldahl Nitrogen (TKN). TKN is the sum of organic nitrogen, NH_3 , and NH_4^+ in the chemical analysis of wastewater. Today, TKN or $\text{NH}_4\text{-N}$ (NH_3 and NH_4^+) is a required parameter for regulatory reporting at many treatment plants, and as a means of monitoring plant operations, because the presence of large concentrations of ammonia in a stream or lake can create a large oxygen demand. This demand is caused by the conversion of ammonia to nitrate.

Nitrate can have serious health effects when it enters drinking water wells and is consumed. Nitrate and other forms of nitrogen can also have deleterious effects on the environment, especially in coastal areas where excess nitrogen stimulates the process known as eutrophication. For this reason, many alternative technologies have been designed to remove total nitrogen (TN), nitrate nitrogen ($\text{NO}_3\text{-N}$), nitrite nitrogen ($\text{NO}_2\text{-N}$) and TKN. These technologies use bacteria to convert ammonia and nitrate to gaseous nitrogen, N_2 . In this form, nitrogen is inert and is released to the air.

Phosphorus

Both phosphorus and nitrogen are essential nutrients for the plants and animals that make up the aquatic food web. Since phosphorus is the nutrient in short supply in most fresh waters, even a modest increase in phosphorus can, under the right conditions, set off a whole chain of undesirable events in a stream including accelerated plant growth, algae blooms, low dissolved oxygen, and the death of certain fish, invertebrates, and other aquatic animals. Thus, there is presently much interest in controlling the amount of phosphorus compounds that enter surface waters from wastewater treatment plants.

The principal forms of phosphorus in wastewater are organically bound phosphorus, polyphosphates, and orthophosphates. Organically bound phosphorus originates from body and food waste and, upon biological decomposition of these solids, is converted to orthophosphates. Polyphosphates, which can be hydrolyzed to orthophosphates, are used in synthetic detergents, and used to contribute as much as one-half of the total phosphates in wastewater. Most household phosphate inputs now come from human waste and automatic dishwasher detergent.

Thus, the principal form of phosphorus in domestic wastewater is assumed to be orthophosphates, although the other forms may exist. Orthophosphates consist of the negative ions PO_4^{3-} , HPO_4^{2-} , and H_2PO_4^- . These may form chemical combinations with cations (positively charged ions).

The total phosphorus (TP) test measures all the forms of phosphorus in the wastewater sample. This is accomplished by first "digesting" (heating and acidifying) the sample to convert all the other forms to orthophosphate. Then the orthophosphate is measured by the ascorbic acid method. Because the sample is not filtered, the procedure measures both dissolved and suspended orthophosphate.

pH/Alkalinity

pH is a measure of the amount of free hydrogen ions in wastewater. Because pH is measured on a logarithmic scale, an increase of one unit indicates an increase of ten times the amount of hydrogen ions. The wastewater treatment bacteria operate most efficiently at a pH of 6.8-7.2 (somewhere around neutral). When the pH drops below 6.0 or rises above 8.5, activity drops off dramatically. As a result, under normal operating conditions, pH of the MBR contents should be in the range of 6.0 to 8.5. If the pH drifts too far out of this range then corrective action is required. A low pH must be increased as soon as possible by the addition of alkaline chemical. Extended aeration at low pH will cause severe membrane fouling as a result of poor biological activity. Measurements of pH can be obtained either in the field with a portable pH meter, or in the laboratory from samples collected by the operator.

Alkalinity is the capacity to neutralize acids, and the alkalinity in wastewater results from the presence of the hydroxides, carbonates and bicarbonates of elements such as calcium, magnesium, sodium, potassium, and ammonia. The alkalinity in wastewater helps to resist change in PH change. Sufficient alkalinity is very essential to the nitrification of wastewater.

Temperature

The biological activity within the MBR system is directly affected by the influent wastewater temperature and ambient temperature. Biological activity (i.e., the rate of removal of organic matter, nitrogen and phosphorus) decreases as the biomass temperature decreases. Membrane flux rate is also affected by temperature. In general, a warmer temperature improves system performance in terms of biological activity rate, and membrane flux rate up to a maximum at approximately 35°C.

Dissolved Oxygen (DO)

The DO concentration in the aeration basin is measured with a DO meter/probe. The objective is to maintain a DO concentration of 1.0 – 2.0 mg/l at all times in the aeration tank.

Viscosity

The sludge viscosity is one parameter used to track the condition of the MBR sludge with system performance. Monitoring of viscosity testing may be required when treating certain type of industrial wastewaters.

Sludge Filterability

Sludge filterability is a key monitoring test to determine the condition of the MBR mixed liquor. Method for determining the sludge filterability is provided in Section 6.2.2.

Fats, Oil and Grease (FOG)

FOG includes the fats, oils, waxes and other related constituents found in wastewater, and is contributed to wastewater in butter, lard, margarine and vegetable fats and oils. FOG can coat and kill bacteria, causing the microorganisms to float out of the system, interfere with oxygen-transfer efficiency, and cause membrane fouling. If FOG is not removed from wastewater, it can interfere with the biological life in the surface waters and create unsightly films.

Bacterial Indicators

Another issue that must be addressed in wastewater treatment is the removal of pathogenic bacteria that can cause water-borne diseases. Wastewater operators need to be mindful of the potential contact with organisms that are responsible for typhoid, cholera, dysentery, and hepatitis.

Coliform bacteria are enteric bacteria. This means that they are found in the intestinal tract of warm-blooded animals, including humans. These bacteria, known as *E. coli* in humans, do not cause disease but are necessary for the digestion of food. The waterborne pathogens are also enteric bacteria and are part of the coliform family. Therefore, if coliform bacteria are present in the water, pathogens may also be present. The coliform bacteria live longer in water and are easier to detect by laboratory testing. This is the reason the coliform group has been chosen as the indicator organism for waterborne pathogens. If coliform bacteria are not present it is assumed there are no pathogens present either. The following are specific organisms that have been used as indicators of fecal contamination of wastewater.

Total Coliform: species of gram-negative rods that may ferment lactose with gas production at $35\pm 0.5^{\circ}\text{C}$. The total coliform group includes four genera in the Enterobacteriaceae family. These are *Escherichia*, *Citrobacter*, *Enterobacter*, and *Klebsiella*. Of the group, the *Escherichia* genus (*E. coli* species) appears to be the most representative of fecal contamination.

Fecal Coliform: A fecal coliform bacteria group was established based on the ability to produce gas at an elevated incubation temperature ($44.5 \pm 0.2^{\circ}\text{C}$ for 24 ± 2 h).

E. coli: The *E. coli* is one of the coliform bacteria populations and is more representative of fecal sources than other coliform genera.

Food to Microorganism Ratio (F:M)

Another important design parameter, the F:M ratio represents a ratio between the mass of food provided and the mass of microorganisms in the wastewater treatment system. The amount of food applied is estimated from the results of the BOD and COD tests. These oxygen demand tests provide a reliable approximation of the actual amount of food available to the microorganisms. The MLSS/MLVSS is a good approximation of the microorganism concentration in the sludge. The F:M ratio is, therefore, expressed in terms of $\text{kg BOD}/(\text{kg MLSS} \cdot \text{d})$, $\text{kg BOD}/(\text{kg MLVSS} \cdot \text{d})$ or $\text{kg COD}/(\text{kg MLSS} \cdot \text{d})$, $\text{kg COD}/(\text{kg MLVSS} \cdot \text{d})$.

APPENDIX I

Process and Chemicals Dosage Calculations

Process and Chemical Dosage Calculations

This section offers calculations for the membrane permeability, chemical dosing, monitoring parameters and excess sludge wasting.

Membrane Permeability

To check the effectiveness of a cleaning procedure, calculate the permeability of the membranes before / after the membrane cleaning.

Please refer to the example below:

Example: The permeate flowrate per module was recorded at 4,200 L/h at a membrane pressure of 0.06 bar. Membrane surface area per module (in case of MB3-3 module) is 315 m². The membranes are operated on a 10 minute cycle, where permeate is withdrawn for 9 minutes followed by 1 minute of relaxation (no permeation). The temperature of the mixed liquor is 15 °C.

- 1) Calculate instantaneous (gross) Flux (**J**), the quantity of wastewater passing through a unit area of membrane module per unit time (LMH or L/(m².h)). Flux is occasionally referred to as the permeate production or filtration velocity.

- a. Instantaneous (Gross) Flux:

$$J_{Inst} = \frac{\text{Flowrate}}{\text{Membrane Area}} = \frac{4200L/h}{315m^2} = 13.3LMH$$

- b. Net Flux:

$$J_{Net} = \frac{\text{Flowrate}}{\text{Membrane Area}} \frac{\text{PermeationTime}}{\text{CycleTime}} = \frac{4200L/h}{315m^2} \frac{9\text{ min}}{10\text{ min}} = 12.0LMH$$

- c. Temperature Corrected Flux:

$$J_{20^\circ C} = J_{Inst@15^\circ C} e^{\theta(20-T)} = 13.3LMH * (2.718)^{0.0239*(20-15)} = 15.0LMH$$

- 2) Calculate membrane permeability (**K**), the ratio of the flux and transmembrane pressure (TMP).

$$K = \frac{J_{20^\circ C}}{TMP} = \frac{15.0LMH}{0.06bar} = 250LMH / bar$$

Note: this parameter has been incorporated on the touch screen and is being monitored via PLC on a continuous basis

Chemical Dosing

To determine the quantity of a chemical required for dosing into the system, refer to the following calculation example.

Example: The aeration tank influent (domestic wastewater) flow rate is 5,000 L/h. The influent total phosphorus (TP) concentration is 10 mg/L, and effluent TP limit is 1 mg/L. The TP uptake through sludge production is 2.5 mg/L. The alum stock solution concentration is 48% by weight, and its density is 1310 kg/m³. Calculate the alum dosage to aeration tank, Q_{Al} , for TP removal.

- 1) Determine the alum concentration needed for phosphorus removal in the aeration tank.

Table C.1: Molar ratio of Al (III) dose to phosphorus removed as a function of effluent TP concentration limit for domestic wastewater

Effluent TP limit (mg/L)	Alum:Phosphorous (mol/mol)
≥ 1	1.0
0.1 - 1	2.0
0.05 – 0.1	2.5
< 0.05	3.5

- Select Al: P ratio = 1.0 mol/mol, because the effluent TP limit is 1 mg/L (See Table C.1)
- Determine the weight of Al required per unit weight of P:

$$\frac{Al}{P} = \frac{1.0 \text{ mol Al} / \text{mol P}}{2 \times 26.98 \text{ g} / \text{mol} / 666.5 \text{ g} / \text{mol}} = 12.4 \text{ g Al} / \text{g P}$$

- Calculate phosphorus required to be removed: $10 - 1 - 2.5 = 6.5 \text{ mg/L}$
- Determine the concentration of alum required, [Al], in the aeration tank:

$$[Al] = 12.4 \text{ g Al} / \text{g P} \times 6.5 \text{ mg} / \text{L} = 80.6 \text{ mg} / \text{L}$$

- 2) Determine the amount of alum solution required per hour, Q_{Al} , which is the alum dosing pump flow rate:

$$Q_{Al} = \frac{5,000 \text{ L} / \text{h} \times 80.6 \text{ mg} / \text{L}}{48\% \times 1310 \text{ kg} / \text{m}^3 \times 1,000 \text{ mg} / \text{g}} = 0.64 \text{ L} / \text{h}$$

Chemical Dosing with Dry Chemicals

To determine the quantity of dry chemical and water to use to make-up a chemical solution refer to the following two calculation examples:

Example: The alkalinity and pH in the system are to be maintained using soda ash (sodium carbonate). The solubility of soda ash is 22 %wt at 20 °C, and has a density of 2.54 g/cm³. The chemical make-up tank can hold 300 L of solution. The soda ash is shipped in 25 kg bags. The influent flow rate is 100 m³/d

1) Determine the amount of dry soda ash need to make-up a batch of soda ash solution:

- Use 20 %wt solution in order to more readily dissolve the soda ash
- Determine the density of the final solution:

$$\rho_{\text{solution}} = 0.2 * 2.54 \text{ g/cm}^3 + (1 - 0.2) * 1.0 \text{ g/cm}^3 = 1.31 \text{ g/cm}^3$$

- Determine the mass of soda ash in 300 L of solution:

$$m_{\text{Na}_2\text{CO}_3} = 300 \text{ L} * 1.31 \text{ g/cm}^3 * \frac{1000 \text{ cm}^3 / \text{L}}{1000 \text{ g/kg}} * 0.2 \text{ kg}_{\text{Na}_2\text{CO}_3} / \text{kg}_{\text{Solution}} = 78.6 \text{ kg}$$

- Therefore 78.6 kg of soda ash are needed, or approximately 75 kg which is 3 X 25 kg bags.

2) Determine the amount of water to use to make-up the soda ash solution

- Determine the volume displaced by the soda ash:

$$V_{\text{Na}_2\text{CO}_3} = \frac{75 \text{ kg}}{2.54 \text{ g/cm}^3} * \frac{1000 \text{ g/kg}}{1000 \text{ cm}^3 / \text{L}} = 29.5 \text{ L of elements}$$

- Determine the volume of water required:

$$V_{\text{H}_2\text{O}} = 300 \text{ L} - 29.5 \text{ L} = 270.5 \text{ L}$$

3) Determine the dosing rate to add 100 mg/L of alkalinity as CaCO₃ to the system.

- Determine the equivalent concentration as soda ash (Na₂CO₃):

$$[\text{Alk}]_{\text{Na}_2\text{CO}_3} = [\text{Alk}]_{\text{CaCO}_3} \frac{\text{MM}_{\text{Na}_2\text{CO}_3}}{\text{MM}_{\text{CaCO}_3}} = 100 \text{ mg/L} \frac{106 \text{ mg/mmol}}{100 \text{ mg/mmol}} = 106 \text{ mg/L}$$

- Determine the dosing rate of soda ash on a mass basis:

$$\dot{m}_{Na_2CO_3} = [Alk]_{Na_2CO_3} * Q_{inf} = 106 \text{ mg} / \text{L} * 100 \text{ m}^3 / \text{d} * \frac{1000 \text{ L} / \text{m}^3}{1000 \text{ mg} / \text{g}} = 10,600 \text{ g} / \text{d}$$

- Determine the dosing rate of soda ash solution on a volume basis:

$$Q_{Na_2CO_3} = \frac{\dot{m}_{Na_2CO_3}}{[Na_2CO_3]} = \frac{10,600 \text{ g} / \text{d}}{250 \text{ g} / \text{L}} = 42.4 \text{ L} / \text{d}$$

Example: A filter press is to be used to dewater sludge, and a polymer is to be used to flocculate the sludge. The polymer make-up concentration is to be 0.2% (2 g/L) and to be made up using dry polymer with a density of 0.8 g/mL. The polymer make-up tank has a capacity of 300 L. The flocculation tank has a capacity of 900 L. The wasted sludge has an MLSS concentration of 1% (10 g/L). The ratio of polymer to sludge should be 10 g/kg on a dry basis.

- 1) Determine the amount of dry polymer required to make up a batch of 0.2% polymer solution:

- Determine mass of dry polymer required

$$m_{DryPolymer} = [Polymer] * V_{PolymerSolution} = (2 \text{ g} / \text{L}) * (300 \text{ L}) = 600 \text{ g}$$

- Determine volume of dry polymer required

$$V_{DryPolymer} = \frac{m_{DryPolymer}}{\rho_{DryPolymer}} = \frac{600 \text{ g}}{0.8 \text{ g} / \text{mL}} = 750 \text{ mL}$$

- Therefore 750 mL of dry polymer, or 3 cups, are required to make-up a batch of 0.2% polymer solution.

- 2) Determine the dose of polymer solution required to flocculate a batch of sludge:

- Determine mass of solids to be flocculated on a dry basis

$$m_{DrySolids} = [MLSS] * V_{Sludge} = (10 \text{ g} / \text{L}) * (900 \text{ L}) = 9000 \text{ g} = 9 \text{ kg}$$

- Determine mass of polymer required to flocculate sludge on a dry basis

$$m_{DryPolymer} = Polymer : SolidsRatio * m_{DrySolids} = (10 \text{ g} / \text{kg}) * (9 \text{ kg}) = 90 \text{ g}$$

- Determine volume of polymer solution required to flocculate sludge

$$V_{PolymerSolution} = \frac{m_{DryPolymer}}{[Polymer]} = \frac{90g}{2g/L} = 45L$$

- Therefore 45 L of 0.2% polymer solution are required per batch to flocculate the 900 L of 1% sludge.

Monitoring Parameters

To determine the food to microorganism (F/M) ratio, BOD loading rate and solids retention time (SRT) refer to the following examples.

Example: The influent flow rate is 100 m³/d with a BOD concentration of 400 mg/L (g/m³). The volume of the reactor (aeration tank and membrane tank) is 100 m³ and contains mixed liquor with a suspended solids concentration of 10,000 mg/L and a MLVSS/MLSS ratio of 0.70. Excess sludge is wasted at a rate of 5 m³/d

- 1) Determine the BOD loading:

$$BOD_{Loading} = \frac{[BOD] * Q_{inf}}{V_{Reactor}} = \frac{(400g/m^3) * 100m^3/d}{100m^3}$$

$$BOD_{Loading} = 400 \frac{g}{m^3 * d} = 0.4 \frac{kg}{m^3 * d}$$

- 2) Determine F/M ratio:

$$F/M = \frac{[BOD] * Q_{inf}}{MLSS * \frac{MLVSS}{MLSS} V_{Reactor}} = \frac{(400g/m^3) * 100m^3/d}{(10,000g/m^3) * (0.70) * (100m^3)}$$

$$F/M = 0.057 \frac{kgBOD}{kgMLVSS * d}$$

- 3) Determine SRT:

$$SRT = \frac{V_{Reactor}}{Q_{WAS}} = \frac{100m^3}{5m^3/d}$$

$$SRT = 20d$$

Excess Sludge Wasting

Excess activated sludge is wasted periodically during the MBR operation. To determine the amount of excess sludge wasted, refer to the following calculation example.

Example: The measured MLSS concentration of activated sludge in aeration tank is 15,000 mg/L. Excess sludge has to be drained to keep its design concentration of 10,000 mg/L. The volume of aeration tank is 100 m³. Calculate the volume of excess sludge (V_s) to be wasted.

$$V_s = \frac{(15,000 - 10,000) \text{ mg} / \text{L} \times 100 \text{ m}^3 \times 1,000 \text{ L} / \text{m}^3}{15,000 \text{ mg} / \text{L}} = 33,333 \text{ L}$$

The operator can set the sludge wasting pump flowrate according to the above calculated volume.

Soda Ash Make-Up Instructions

1. Fill soda ash make-up tank approximately $\frac{3}{4}$ full of 20 °C water
 - MBR permeate may be used
2. Turn on mixer M-6101
3. Slowly add sodium carbonate to make up a 20%wt solution(Rule of thumb: 1 X 25 kg bag per 100 L)
 - This is based on 20 °C water. If water temperature is colder, the solubility will be lower.
 - Check between additions of each bag to ensure sodium carbonate is dissolving. If sodium carbonate is not dissolving, do not add any more.
4. Once fully dissolve, turn off mixer M-6101

Caution: This soda ash make-up process is exothermic (generates heat), and personal protective equipment for chemicals handling must be worn.

APPENDIX J

newterra MicroClear™ Membrane Clean Water Testing Sheet & Cleaning Log Sheet

newterra MicroClear™ MEMBRANE CLEAN WATER TESTING SHEET – MBR HYDRAULICS

Clean Water Test Information	
Date	
Performed By	
Observed By	

Plant Conditions	
Ambient Temperature	
Water Temperature	
Normal Operating Level	
Static Pressure at Normal Operating Level	

MEMBRANE TANK HYDRAULICS

Flux (LMH)	Flow Rate (Lpm)	TMP during steady flow (bar)	Permeability (LMH/bar)

newterra MicroClear™ MEMBRANE CLEANING LOG SHEET

Precautions have to be taken to handle membrane chemical cleaning.



Chemical cleaning is only to be carried out by qualified and trained personnel! Chemicals can lead to serious injuries. Always wear personal protective equipment (PPE) when handling chemicals! Obey the chemical safety handling procedure, as listed in the Material Safety Data Sheets.

[illegible]

**Normal permeability after cleaning: 150 to 300 LMH/bar. Repeat the cleaning procedures if the normal permeability value is not attained.*

APPENDIX K

Control Narrative



1704432 - Agnico Eagle System Control Narrative - Test Protocol

Revision	YYYY-MM-DD	Description	By
A	2017-05-25	Submittal	JJK
C	2017-05-11	As-Built	JJK



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System Inputs

Module	Tag	Description	Input Type	HMI Display Units	Device Range and Units	Device Span/PLC Scale	Datalog (Y)	Trending (Y)	Notes	Input Verification
100	FIT-101	Flow Indicating Transmitter	Analog	GPM	0-760lpm	0-760lpm	Y	Y		
100	FQI-101	Flow Totalizer	Discrete N.O.	Pulse/Gal	1 liter/ Pulse					
100	LSHH-101	Level Switch High High	Discrete N.C.							
100	LSHH-102	Level Switch High High	Discrete N.C.							
100	LSHH-103	Level Switch High High	Discrete N.C.							
200	FIT-201	Flow Indicating Transmitter	Analog	GPM	0-760lpm	0-760lpm	Y	Y		
200	FQI-201	Flow Totalizer	Discrete N.O.	Pulse/Gal	1 liter/ Pulse					
200	LSHH-201	Level Switch High High	Discrete N.C.							
200	LSHH-202	Level Switch High High	Discrete N.C.							



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System Inputs

Module	Tag	Description	Input Type	HMI Display Units	Device Range and Units	Device Span/PLC Scale	Datalog (Y)	Trending (Y)	Notes	Input Verification
200	LSHH-203	Level Switch High High	Discrete N.C.							
200	LSH-203	Level Switch High	Discrete N.C.							
200	LSL-203	Level Switch Low Low	Discrete N.O.							
300	LSHH-301	Level Switch High High	Discrete N.C.							
300	LT-301	Level Transmitter	Analog	%	0-10 ftWC	0-10 ftWC	Y	Y		
300	TT-301	Temperature Transmitter	Analog	°C	0-100c	0-100c	n	n	Added to System	
300	LSL-301	Level Switch Low Low	Discrete N.O.						Must be above all immersion heaters in Tank	
300	PSL-301	Pressure Switch Low	Discrete N.C.		9-85"WC					



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System Inputs

Module	Tag	Description	Input Type	HMI Display Units	Device Range and Units	Device Span/PLC Scale	Datalog (Y)	Trending (Y)	Notes	Input Verification
400	LSHH-401	Level Switch High High	Discrete N.C.							
400	TSL-401	Temperature Switch Low	Discrete N.C.							
400	LSLL-401	Level Switch Low Low	Discrete N.O.							
500	LSHH-501	Level Switch High High	Discrete N.C.							
500	LSLL-501	Level Switch Low Low	Discrete N.O.						Must be above all immersion heaters in Tank	
500	PH-501	pH Transmitter	Analog		0-14 pH		Y	Y		
500	DO-501	Dissolved Oxygen Transmitter	Modbus	ppm	0-10		Y	Y		
500	TT-501	Temperature Transmitter	Modbus	°C	0-100					
500	LT-501	Level Transmitter	Analog	%	0-10 ft		Y	Y		



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System Inputs

Module	Tag	Description	Input Type	HMI Display Units	Device Range and Units	Device Span/PLC Scale	Datalog (Y)	Trending (Y)	Notes	Input Verification
500	PSL-501	Pressure Switch Low	Discrete N.C.		9-85"WC					
500	LSHH-502	Level Switch High High	Discrete N.C.							
500	LSLL-502	Level Switch Low Low	Discrete N.O.						Must be above all immersion heaters in Tank	
500	TSL-502	Temperature Switch Low	Discrete N.C.							
600	LSHH-601	Level Switch High High	Discrete N.C.							
600	LSH-601	Level Switch High	Discrete N.O.							
600	LSHH-602	Level Switch High High	Discrete N.C.							
600	LSH-602	Level Switch High	Discrete N.O.							
600	PSL-601	Pressure Switch Low	Discrete N.C.		9-85"WC					



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System Inputs

Module	Tag	Description	Input Type	HMI Display Units	Device Range and Units	Device Span/PLC Scale	Datalog (Y)	Trending (Y)	Notes	Input Verification
600	PSL-602	Pressure Switch Low	Discrete N.C.		9-85"WC					
700	VT-701	Vacuum Transmitter	Analog	Bar	-1.0 - 1.0 Bar		Y	Y		
700	VT-702	Vacuum Transmitter	Analog	Bar	-1.0 - 1.0 Bar		Y	Y		
700	VFD-701	VFD Status	Communication							
700	VFD-702	VFD Status	Communication							
700	FIT-701	Flow Indicating Transmitter	Analog	GPM	0-300bpm		Y	Y		
700	FQI-701	Flow Totalizer	Discrete N.O.	Pulse/Gal	1liter / Pulse					
700	FIT-702	Flow Indicating Transmitter	Analog	GPM	0-300bpm		Y	Y		
700	FQI-702	Flow Totalizer	Discrete N.O.	Pulse/Gal	1liter / Pulse					



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System Inputs

Module	Tag	Description	Input Type	HMI Display Units	Device Range and Units	Device Span/PLC Scale	Datalog (Y)	Trending (Y)	Notes	Input Verification
800	LSH-801	Level Switch High	Discrete N.C.							
800	LSL-801	Level Switch Low Low	Discrete N.O.							
900	LSHH-901	Level Switch High High	Discrete N.C.							
7900	PSL-7911	Pressure Switch Low	Discrete N.O.		0.4 - 1.6"WC				Proof of Continuous Ventilation.	
7900	LSHH-7911	Level Switch High High	Discrete N.C.							
7900	TSSL-7911	Temperature Switch Low Low	Discrete N.C.	°F	-30-100 °F					



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System Inputs

[illegible]



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System Inputs

Module	Tag	Description	Input Type	HMI Display Units	Device Range and Units	Device Span/PLC Scale	Datalog (Y)	Trending (Y)	Notes	Input Verification



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System Setpoints

Module	Tag	Description	Factory Setpoint	Setpoint Range and Units	Setpoint Change Control	Alarm setpoint (Y/N)	Notes	Setpoint Verification
100	FTAH-101-SP	Flow Transmitter Alarm High Setpoint	75	0-200 GPM	Open	Y		
200	FTAH-201-SP	Flow Transmitter Alarm High Setpoint	75	0-200 GPM	Open	Y		
300	LTL-301-SP	Level Transmitter Low Setpoint	10%	0-100%	Open			
300	LTHFLUX-301-SP	High Flux Level Setting	50%	0-100%			Puts the MBR Permeate pumps into High Flux Mode	
300	LTH-301-SP	Level Transmitter High Setpoint	80%	50-100%	Open			
500	LTL-501-SP	Level Transmitter Low Setpoint	70%	0-100%	Open			
500	LTH-501-SP	Level Transmitter High Setpoint	80%	0-100%	Open			

System Setpoints

Module	Tag	Description	Factory Setpoint	Setpoint Range and Units	Setpoint Change Control	Alarm setpoint (Y/N)	Notes	Setpoint Verification
500	LT501-SLUDGE-SP	Waste Level for P-503	75%	0-100%	Open			
500	LT501-PERM-SP	Level Control for Permeate Pumps	75%	0-100%	Open		If Level drops below, permeate pumps will stop	
500	P503 WASTE HOUR	When P-503 will waste	12pm	0-23				
500	P503 WASTE SP	Time that P-503 wastes for	10min	0-99				
500	PH-501-SP	pH Normal Setpoint	7 pH	6-8pH	Open			
500	PHAH-501-SP	pH Alarm High Setpoint	8 pH	7 - 14 pH	Open	Y		
500	PHAL-501-SP	pH Alarm Low Setpoint	6 pH	0-7 pH	Open	Y		
500	DO-501-SP	Dissolved Oxygen Normal Setpoint	2 ppm	0-6 ppm	Open			
500	B500 I SP	Integral Gain setting DO PID Loop	10s	0-99				
500	B500 P SP	Proportional Gain setting DO PID Loop	100%	0-99				



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System Setpoints

Module	Tag	Description	Factory Setpoint	Setpoint Range and Units	Setpoint Change Control	Alarm setpoint (Y/N)	Notes	Setpoint Verification
500	B501 MAN SP	Manual Speed B-501	50%	0-100				
500	B502 MAN SP	Manual Speed B-502	50%	0-100				
500	DOAL-501-SP	Dissolved Oxygen Alarm Low Setpoint	0.5 ppm	0-6 ppm	Open	Y		
500	ALUM DOSE	Alum Dose setting (xGal per Pulse)	10 Gallons	0-99 Gallons	Open		Setpoint controls a single pulse of Alum P-6101 dosing.	
500	MICROC DOSE	Micro C Dose setting (xGal per Pulse)	10 Gallons	0-99 Gallons	Open		Setpoint controls a single pulse of Alum P-6101 dosing.	
500	TALL-501-SP	Temperature Alarm Low Low	10 deg C	5 - 25 deg C	Password	Y		
500	TTL-501-SP	Temperature Transmitter Low Setpoint	15 deg C	5-25 deg C	Open			
500	PAL-501-SP	Pressure Alarm Low Setpoint	28"WC (PSIG)		On Device	Y		
500	TALL-502-SP	Temperature Alarm Low Low	10 deg C	5 - 25 deg C	Password	Y		

System Setpoints

Module	Tag	Description	Factory Setpoint	Setpoint Range and Units	Setpoint Change Control	Alarm setpoint (Y/N)	Notes	Setpoint Verification
700	VT-701-SP	MBR-1 Vac Mode Permeate Setpoint	-0.1 bar	-0.2 - 0 bar	Open			
700	VT-701-HFSP	MBR-1 Vac Mode Permeate High Flux Setpoint	-0.15 bar	-0.2 - 0 bar	Open			
700	VTAH-701-SP	MBR-1 Vacuum Transmitter Alarm High	-0.3 bar	-0.3 - 0 bar	Open	Y		
700	VT-702-SP	MBR-2 Vac Mode Permeate Setpoint	-0.1 bar	-0.2 - 0 bar	Open			
700	VT-702-HFSP	MBR-2 Vac Mode Permeate High Flux Setpoint	-0.15 bar	-0.2 - 0 bar	Open			
700	VTAH-702-SP	MBR-2 Vacuum Transmitter Alarm High	-0.3 bar	-0.3 - 0 bar	Open	Y		
700	FT-701-SP	MBR-1 Flow Mode Permeate Setpoint	60 GPM	0-200	Open			
700	FT-701-HFSP	MBR-1 Flow Mode Permeate High Flux Setpoint	75%	0-200	Open			
700	FTAH-701-SP	MBR-1 Flow Transmitter Alarm High Setpoint	100	0-200	Open	Y		
700	FTAL-701-SP	MBR-1 Flow Transmitter Alarm Low Setpoint	10	0-200	Open	Y		

System Setpoints

Module	Tag	Description	Factory Setpoint	Setpoint Range and Units	Setpoint Change Control	Alarm setpoint (Y/N)	Notes	Setpoint Verification
700	FT-702-SP	MBR-2 Flow Mode Permeate Setpoint	60 GPM	0-200	Open			
700	FT-702-HFSP	MBR-2 Flow Mode Permeate High Flux Setpoint	75GPM	0-200	Open			
700	FTAH-702-SP	MBR-2 Flow Transmitter Alarm High Setpoint	100	0-200	Open	Y		
700	FTAL-702-SP	MBR-2 Flow Transmitter Alarm Low Setpoint	10	0-200	Open	Y		
GLOBAL	BKWSH-TIME-SP	Backwash Time Setpoint	120s	0-999 s	Open			
GLOBAL	RELAX-SP	Number of Relaxes Before Backwash	6	0-999	Open			
GLOBAL	PERM-PULL-TIME	Permeate Pull Time	9m	0-30m	Open			
GLOBAL	RELAX-TIME	Membrane Relax Time	60s	0-999 s	Open			
GLOBAL	FLUX-SP	High Flux Setpoint	75%	50-100%	Open		Reading based on LT-301	



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System Setpoints

<u>Module</u>	<u>Tag</u>	<u>Description</u>	<u>Factory Setpoint</u>	<u>Setpoint Range and Units</u>	<u>Setpoint Change Control</u>	<u>Alarm setpoint (Y/N)</u>	<u>Notes</u>	<u>Setpoint Verification</u>
GLOBAL	SLUDGE-WASTE-TOD	Time of Day to Start Sludge Wasting	23hr	0-23 hr	Open			
GLOBAL	SLUDGE-WASTE-TIME	Duration of Sludge Wasting	60m	0-1000m	Open			



System Outputs and Modes of Operation

Module	Tao / Mode	Description	Control Logic	Alarm Interactions	Output Type	Hour Meter	Amp Meter	HOA Control	Output Verification	Logic Verification
		Start/Stop	The system will start when the start button is pressed on the HMI.							
		Start/Stop	The system will automatically restart after recovery from a power failure after a 30 second delay, unless the Start button is pressed first.							
		Start/Stop	To stop the system press the stop button on the HMI display.							
		Start/Stop	The system will shut down under some alarm conditions, see the modules below for these specific circumstances.							
		Start/Stop	All equipment will have to be put in "AUTO" in order to operate with the exception of heaters, auto-drain valves, building fans or self-governed equipment (such as screw compressors, air dryers, etc.).							
		Start/Stop	Note: when components are put in "HAND" mode the "AUTO" logic described below will be bypassed and the component will run regardless of inputs (unless the emergency stop button is activated). This is done for on-site testing and troubleshooting purposes. When a soft HOA switch (a software based toggle switch present in remote telemetry or HMI based systems) is used, a 2 minute safety timer is used on all components to prevent running them dry or excessive flooding due to operator error. Hand Timers can be Overridden by touching the pressing and holding the newterra watermark on the Control Bar. By enabling the override the user assumes responsibility for operating the system outside the control parameters set by newterra. While override is enabled all Hand timers and interlocks are ignored.							
N/A	N/A	HMI Datalogging	DO and pH will be logged and displayed on the HMI on the same plot.							
N/A	N/A	HMI Datalogging	Flux and Permeability data will be logged and displayed on the HMI on the same plot.							



System Outputs and Modes of Operation

<u>Module</u>	<u>Tao / Mode</u>	<u>Description</u>	<u>Control Logic</u>	<u>Alarm Interactions</u>	<u>Output Type</u>	<u>Hour Meter</u>	<u>Amp Meter</u>	<u>HOA Control</u>	<u>Output Verification</u>	<u>Logic Verification</u>
N/A	N/A	MBR-1 Enable	HMI will contain an MBR-1 Enable button. When selected, MBR-1 is enabled.							
N/A	N/A	MBR-2 Enable	HMI will contain an MBR-2 Enable button. When selected, MBR-2 is enabled.							
N/A	N/A	Flow Mode	HMI will contain a Flow Mode Enable button. When selected the permeate system will operate in Flow Mode.							
N/A	N/A	Vac Mode	HMI will contain a Vac Mode Enable button. When selected the permeate system will operate in Vac Mode.							
100	YC-101	Ready Contact	On when LSHH-101 / 102 / 103 and LSHH-201 / 202 and LSHH-203 are not ON	All LSHH's in the inlet area				HOA		
200	YC-201	Ready Contact	On when LSH-201 / 202 and LSHH-203 are not ON					HOA		
200	SCR-201	Inlet Screen	The inlet screen will be ON when influent flow is detected via flow transmitter FIT-201. The screen will run for 1 minute after influent flow has stopped via flow transmitter FIT-201. If the high high level switch LSHH-201 on the screen is ON then the inlet screen SCR-201 will be ON.		Discrete	Y		HOA		



System Outputs and Modes of Operation

<u>Module</u>	<u>Tao / Mode</u>	<u>Description</u>	<u>Control Logic</u>	<u>Alarm Interactions</u>	<u>Output Type</u>	<u>Hour Meter</u>	<u>Amp Meter</u>	<u>HOA Control</u>	<u>Output Verification</u>	<u>Logic Verification</u>
200	SCR-202	Inlet Screen	Same as SCR-201		Discrete	Y		HOA		
200	P-201	Screen Transfer Pump	The pump will be ON when the LSH-203 turn on as long as LT-301 < LTH-301-sp setpoint the pump will turn off when the LSL-201 turns off	LAHH-301	Discrete	Y		HOA		
200	P-202	Screen Transfer Pump	This pump runs duty standby with P-201 with a 5:1 ratio	LAHH-301	Discrete	Y		HOA		
300	H-301	Tank Heater	On When TT-301 < 10C Off when TT-301 > 15C	LALL-301	Discrete					
300	H-302	Tank Heater	Same as H-301	LALL-301	Discrete					
300	P-301	EQ Transfer Pump	The EQ pump will be ON when the EQ level transmitter LT-301 > LT-301-SP and the aeration tank level transmitter LT-501 < LTH-501-SP The EQ pump will be OFF when the EQ level transmitter LT-301 < LT-301-SP OR LSL-301 = InActive OR the aeration tank level transmitter LT-501 > LTH-501-SP OR LSHH-401 is active Runs Duty with P-302 as Standby	Turns OFF LAHH-501 LAHH-401 LALL-301	Discrete	Y		HOA		
300	P-302	EQ Transfer Pump	This pump runs duty standby with P-201 with a 5:1 ratio			Y		HOA		
300	B-301	EQ Blower	The EQ blower will be ON when the System is in Run & LSL-301 is active.			Y		HOA		



System Outputs and Modes of Operation

<u>Module</u>	<u>Tao / Mode</u>	<u>Description</u>	<u>Control Logic</u>	<u>Alarm Interactions</u>	<u>Output Type</u>	<u>Hour Meter</u>	<u>Amp Meter</u>	<u>HOA Control</u>	<u>Output Verification</u>	<u>Logic Verification</u>
300	B-302	EQ Blower	Runs Duty standby with B-301 switching every 120 hours		Discrete	Y		HOA		
400	P-401	Pre-Anox Mixing Pump	The pump will be ON when the System is in Run & LSLL-401 is active.	LALL-401 PUMP IS OFF	Discrete	Y		HOA		
400	P-402	Pre-Anox Mixing Pump	Runs Duty standby with P-401 switching every 120 hours		Discrete	Y		HOA		
400	H-401	Tank Heater	On when TSL-401 is OFF	LALL-401	Discrete					
400	H-402	Tank Heater	On when TSL-401 is OFF	LALL-401	Discrete					
6100	P-6102	Alum Dosing Pump	Alum Dosing Pump P-6102 be ON when FIT-701 has reached a user adjustable volume of permeate via FT-701-DOSE seipoint. P-6102 will be ON for one pulse.		Discrete			HOA		
6100	P-6101	Caustic Dosing Pump	Caustic Dosing Pump P-6101 will be ON when PH-501 < PH-501-SP. The pump will be ON for 30s and OFF for 30s and will operate in pause mode		Discrete			HOA		
500	H-501	Tank Heater	On when TSL-501 is OFF	LALL-501	Discrete					



System Outputs and Modes of Operation

<u>Module</u>	<u>Tao / Mode</u>	<u>Description</u>	<u>Control Logic</u>	<u>Alarm Interactions</u>	<u>Output Type</u>	<u>Hour Meter</u>	<u>Amp Meter</u>	<u>HOA Control</u>	<u>Output Verification</u>	<u>Logic Verification</u>
500	H-502	Tank Heater	On when TSL-501 is OFF	LALL-501	Discrete					
500	P-503	Waste Activated Sludge Pump	The waste activated sludge pump will be ON at time of day setting SLUDGE-WASTE-TOD IF level switch LT501-SLUDGE-SP	LAHH-901: Pump will be OFF	Discrete			HOA		
500	H-503	Tank Heater	On when TSL-502 is OFF	LALL-502	Discrete					
500	H-504	Tank Heater	On when TSL-502 is OFF	LALL-502	Discrete					
500	P-501	Aeration Recirc Pump	The pump will run as long as LSL-501 is Active	LALL-502: Pump will be OFF	Discrete	Y		HOA		
500	P-502	Aeration Recirc Pump	Runs Duty standby with p-501 switching every 120 hours		Discrete	Y		HOA		
500	B-501	Aeration Tank Aeration Blower	ON - Always Runs via PID loop to maintain DO-501-SP Runs Duty/Standby 120 hours with B-502.		Direct	Y		HOA		
500	B-502	Aeration Tank Aeration Blower	Runs via same logic as B-501 Runs Duty/Standby every 120 hours with B-501.		Direct	Y		HOA		



System Outputs and Modes of Operation

<u>Module</u>	<u>Tao / Mode</u>	<u>Description</u>	<u>Control Logic</u>	<u>Alarm Interactions</u>	<u>Output Type</u>	<u>Hour Meter</u>	<u>Amp Meter</u>	<u>HOA Control</u>	<u>Output Verification</u>	<u>Logic Verification</u>
550	P-553	Post Anox Mix Pump	The pump will run as long as LSSL-501 is Active	LALL-501: Pump will be OFF	Discrete	Y		HOA		
550	P-554	Post Anox Mix Pump	Runs Duty standby with p-501 switching every 120 hours		Discrete	Y		HOA		
6100	P-6103	Micro C Dosing Pump	Dosing Pump will be ON when FIT-701 or FT-702 has reached a user adjustable volume of permeate via DOSE setpoint.		Discrete			HOA		
550	P-551	Aeration Transfer Pump Feed to MBR-1	The aeration pump will feed MBR tank T-501. The pump will be ON when level transmitter LT-501 > LTL-501-SP and LSSL-501 = Active and LSSL-502 = Active and MBR-1 is Enabled. The aeration pump will be cycle ON/OFF when LT-501 < LTL-501-SP and be OFF if LSSL-501 = InActive OR LSSL-502 = InActive	LAHH-501: Pump will be OFF MBR-1 Disabled	Discrete	Y		HOA		
550	P-552	Aeration Transfer Pump Feed to MBR-2	The aeration pump will feed MBR tank T-502. The pump will be ON when level transmitter LT-501 > LTL-501-SP and LSSL-501 = Active and LSSL-502 = Active and MBR-2 is Enabled. The aeration pump will cycle ON/OFF when LT-501 < LTL-501-SP and be OFF if LSSL-501 = InActive OR LSSL-502 = InActive	LAHH-502: Pump will be OFF MBR-2 Disabled	Discrete	Y		HOA		
600	B-601	MBR Tank Blower	The membrane tank blower will be ON when the System is in Run. And the MBR 1 is enabled	MBR-1 Disabled	Discrete	Y		HOA		
600	B-602	MBR Tank Blower	The membrane tank blower will be ON when the System is in Run. And the MBR 2 is enabled	MBR-2 Disabled	Discrete	Y		HOA		



System Outputs and Modes of Operation

Module	Tag / Mode	Description	Control Logic	Alarm Interactions	Output Type	Hour Meter	Amp Meter	HOA Control	Output Verification	Logic Verification
700	P-701	Permeate Transfer Pump	<p>The permeate pump will be ON when MBR-1 is Enabled & level switch LSH-801 = Active & LT-501 > LT501-PERM-SP. The Pump will perform a PULL/RELAX Cycle. The pump will be ON for the duration specified by the PERM-PULL-TIME setpoint and then be OFF for the duration of the RELAX-TIME setpoint. This will generate one PULL/RELAX Cycle.</p> <p>The VFD Speed of the pump will operate based on the following:</p> <p>In FLOW MODE:</p> <p>The VFD Speed will operate based on a PID loop to maintain the flowrate setpoint FT-701-SP.</p> <p>IF the vacuum transmitter VT-701 > -0.25 bar then the pump will switch to VAC MODE.</p> <p>IF the level transmitter LT-301 > FLUX-SP, the pump will run via PID loop to maintain a high flow setpoint FT-701-HFSP</p> <p>In VAC MODE:</p> <p>The VFD Speed will operate based on a PID loop to maintain the vacuum setpoint VT-701-SP.</p> <p>IF the level transmitter LT-301 > FLUX-SP, the pump will run via PID loop to maintain a high flow setpoint VT-701-HFSP</p> <p>P-701 will be OFF if P-501 is OFF.</p>	~701: Pump Will be Active	Communication	Y		HOA		
700	P-702	Permeate Transfer Pump	<p>The permeate pump will be ON when MBR-2 is Enabled & level switch LSH-602 = Active & LT-501 > LT501-PERM-SP. The Pump will perform a PULL/RELAX Cycle. The pump will be ON for the duration specified by the PERM-PULL-TIME setpoint and then be OFF for the duration of the RELAX-TIME setpoint. This will generate one PULL/RELAX Cycle.</p> <p>The VFD Speed of the pump will operate based on the following:</p> <p>In FLOW MODE:</p> <p>The VFD Speed will operate based on a PID loop to maintain the flowrate setpoint FT-702-SP.</p> <p>IF the vacuum transmitter VT-702 > -0.25 bar then the pump will switch to VAC MODE.</p> <p>IF the level transmitter LT-301 > FLUX-SP, the pump will run via PID loop to maintain a high flow setpoint FT-702-HFSP</p> <p>In VAC MODE:</p> <p>The VFD Speed will operate based on a PID loop to maintain the vacuum setpoint VT-702-SP.</p> <p>IF the level transmitter LT-301 > FLUX-SP, the pump will run via PID loop to maintain a high flow setpoint VT-702-HFSP</p> <p>P-702 will be OFF if P-502 is OFF.</p>	~703: Pump Will be Active	Communication	Y		HOA		
800	SV-801	Clean In Place Tank Fill Solenoid Valve	<p>The Solenoid Valve SV-801 will be Open (Energized) when level switch LSH-801 is InActive and MBR-1 OR MBR-2 are not in Backwash.</p> <p>The Solenoid Valve SV-801 will be Closed (De-Energized) when LSH-801 is Active or if MBR-1 OR MBR-2 are in Backwash.</p>		Discrete			HOA		
700	MV-701	Backwash Actuated Valve	<p>A Backwash is enabled once the permeate pumps for MBR-1 reach the number of PULL/RELAX cycles designated by the RELAX-SP on the HMI.</p> <p>the The actuated valve will be OPEN when MBR-1 is in Backwash and level switch LSH-801 is Active.</p> <p>If MBR-2 is already in backwash, MBR-1 will complete 1 additional PULL/RELAX Cycle before starting a Backwash Cycle.</p>		Discrete			HOA		
700	MV-702	Backwash Actuated Valve	<p>A Backwash is enabled once the permeate pumps for MBR-2 reach the number of PULL/RELAX cycles designated by the RELAX-SP on the HMI.</p> <p>the The actuated valve will be OPEN when MBR-2 is in Backwash and level switch LSH-801 is Active.</p> <p>If MBR-2 is already in backwash, MBR-1 will complete 1 additional PULL/RELAX Cycle before starting a Backwash Cycle.</p>		Discrete			HOA		



System Outputs and Modes of Operation

<u>Module</u>	<u>Tao / Mode</u>	<u>Description</u>	<u>Control Logic</u>	<u>Alarm Interactions</u>	<u>Output Type</u>	<u>Hour Meter</u>	<u>Amp Meter</u>	<u>HOA Control</u>	<u>Output Verification</u>	<u>Logic Verification</u>
800	P-801	Backwash Transfer Pump	The backwash transfer pump will be ON when MBR-1 OR MBR-2 are in Backwash and level switch LSH-801 is Active The backwash transfer pump will be OFF after the duration of BKWSH-TIME-SP OR level switch LSL-801 becomes InActive.		Discrete			HOA		
7911	B-7911	Ventilation Blower	The continuous ventilation blower will always be ON. This blower is used as means to de-rate the screen building to a Class 1 Division 2 area. Air exchanges must be a minimum of 12 per hour.		Direct (not PLC controlled)					
7901	HT-7911	Heat Trace	Always on internally controlled		Direct (not PLC controlled)					
7901	HT-7912	Heat Trace	Always on internally controlled		Direct (not PLC controlled)					
7901	HT-7913	Heat Trace	Always on internally controlled		Direct (not PLC controlled)					
7901	H-7911	Building Heater	Always on internally controlled		Direct (not PLC controlled)					
7901	H-7912	Building Heater	Always on internally controlled		Direct (not PLC controlled)					
7904	B-7941	Aeration Exhaust Blower	On when B-501/502 is on OR B-601/602 is on		Discrete			Auto		
7904	H-7941	Building Heater	Always on internally controlled		Direct (not PLC controlled)					
7906	H-7961	Building Heater	Always on internally controlled		Direct (not PLC controlled)					



System Outputs and Modes of Operation

<u>Module</u>	<u>Tao / Mode</u>	<u>Description</u>	<u>Control Logic</u>	<u>Alarm Interactions</u>	<u>Output Type</u>	<u>Hour Meter</u>	<u>Amp Meter</u>	<u>HOA Control</u>	<u>Output Verification</u>	<u>Logic Verification</u>
7906	H-7962	Building Heater	Always on internally controlled		Direct (not PLC controlled)					
7906	H-7963	Building Heater	Always on internally controlled		Direct (not PLC controlled)					
7906	F-7963	Building Fan	Always on controlled by Wall Mount Thermostat		Direct (not PLC controlled)					



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System Alarms

<u>Module</u>	<u>Alarm</u>	<u>Alarm Description</u>	<u>Actuation Control</u>	<u>Delay</u>	<u>Email Notification (Y)</u>	<u>Self Resetting (Y)</u>	<u>System Shutdown (Y)</u>	<u>Notes</u>	<u>Alarm Verification</u>
100	FTAH-101	Flow Transmitter Alarm High	FIT-101 > FTAH-101-SP	60s					
100	LAHH-101	Level Alarm High High	LSHH-101 = Active	5s		Y			
100	LAHH-102	Level Alarm High High	LSHH-102 = Active	5s		Y			
100	LAHH-103	Level Alarm High High	LSHH-103 = Active	5s		Y			
200	FTAH-201	Flow Transmitter Alarm High	FIT-201 > FTAL-201-SP	60s					
200	LAHH-201	Level Alarm High High	LSHH-201 = Active	5s		Y			
200	LAHH-202	Level Alarm High High	LSHH-202 = Active	5s		Y			
200	LAHH-203	Level Alarm High High	LSHH-203 = Active	5s		Y			

System Alarms

Module	Alarm	Alarm Description	Actuation Control	Delay	Email Notification (Y)	Self Resetting (Y)	System Shutdown (Y)	Notes	Alarm Verification
300	LAHH-301	Level Alarm High High	LSHH-301 = Active	5s		Y			
300	LALL-301	Level Alarm Low Low	LSLL-301 = Off	5s		Y			
400	LAHH-401	Level Alarm High High	LSHH-401 = Active	5s		Y			
400	LALL-401	Level Alarm Low Low	LSLL-401 = OFF	5s		Y			
500	LAHH-501	Level Alarm High High	LSHH-501 = Active	5s		Y			
500	LAHH-502	Level Alarm High High	LSHH-501 = Active	5s		Y			
500	PHAH-501	pH Alarm High	pH-501 > PHAH-501-SP	60s					
5800	PHAL-501	pH Alarm Low	pH-501 < PHAL-501-SP	60s					
500	DOAL-501	Dissolved Oxygen Alarm Low	DO-501 < DOAL-501-SP	15m					
500	DOALL-501	Dissolved Oxygen Alarm Low Low	DO-501 < DOAL-501-SP	4hrs					



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System Alarms

<u>Module</u>	<u>Alarm</u>	<u>Alarm Description</u>	<u>Actuation Control</u>	<u>Delay</u>	<u>Email Notification (Y)</u>	<u>Self Resetting (Y)</u>	<u>System Shutdown (Y)</u>	<u>Notes</u>	<u>Alarm Verification</u>
500	TTAL-501	Low Temp TNK-501	TT-501 < TTAL-501-SP						
500	PAL-501	Pressure Alarm Low	PSL-501 = InActive	5s		Y			
500	VFDA-501	VFD Fault							
500	VFDA-502	VFD Fault							
500	LALL-501	Low Low Level TNK-501	LSLL-501 = OFF						
500	LALL-502	Low Low Level TNK-502	LSLL-502 = OFF						
600	LAHH-601	Level Alarm High High	LSHH-601 = Active	5s		Y		Membrane Tank	
600	LAHH-602	Level Alarm High High	LSHH-602 = Active	5s		Y		Membrane Tank	
600	PAL-601	Pressure Alarm Low	PSL-601 = InActive	5s		Y		Membrane Blowers	



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System Alarms

<u>Module</u>	<u>Alarm</u>	<u>Alarm Description</u>	<u>Actuation Control</u>	<u>Delay</u>	<u>Email Notification (Y)</u>	<u>Self Resetting (Y)</u>	<u>System Shutdown (Y)</u>	<u>Notes</u>	<u>Alarm Verification</u>
600	PAL-602	Pressure Alarm Low	PSL-602 = InActive	5s		Y		Membrane Blowers	
700	VTAH-701	Vacuum Transmitter Alarm High	VT-701 < VTAH-701-SP	5s		Y			
700	VTAH-702	Vacuum Transmitter Alarm High	VT-702 < VTAH-702-SP	5s		Y			
700	VFDA-701	VFD Fault							
700	VFDA-702	VFD Fault							
700	FTAH-701	Flow Transmitter Alarm High	FIT-701 > FTAH-701-SP	60s					
700	FTAL-701	Flow Transmitter Alarm Low	FIT-701 < FTAL-701-SP	60s					
700	FTAH-702	Flow Transmitter Alarm High	FIT-702 > FTAH-702-SP	60s					

System Alarms

Module	Alarm	Alarm Description	Actuation Control	Delay	Email Notification (Y)	Self Resetting (Y)	System Shutdown (Y)	Notes	Alarm Verification
700	FTAL-702	Flow Transmitter Alarm Low	FIT-702 < FTAL-702-SP	60s					
900	LAHH-901	Level Alarm High High	LSHH-901 = Active	5s		Y		Aerobic Digester Tank	
7910	PAL-7911	Pressure Alarm Low	PSL-7911 = InActive	5s		Y		Alarm indicates possible continuous ventilation failure, indicating risk that the room may become Class 1 Division 1 rated.	
7910	TALL-7911	Temperature Alarm Low Low	TSSL-7911 = Active	5s		Y			
7910	LAHH-7911	Level Alarm High High	LSHH-7911 = Active	Immediate					
7940	TALL-7941	Temperature Alarm Low Low	TSSL-7941 = Active	5s		Y			
7961	LAHH-7961	Level Alarm High High Sump	LSHH-7961 - OFF						
7960	TALL-7961	Low Low Temp Aslim	LSSL-7961 = Active						

System Alarms

Module	Alarm	Alarm Description	Actuation Control	Delay	Email Notification (Y)	Self Resetting (Y)	System Shutdown (Y)	Notes	Alarm Verification
8200	ESA-8201	Emergency Stop Alarm	ESA-8201 = Active	Immediate		Y			
8200	PWR-FAIL	Power Failure		Immediate		Y			
8200	PLC FLT	PLC Fault Detected		Immediate		Y			
8200	PWR FLT	Phase Monitor Fault	JA-8201 = Active	Immediate		Y			

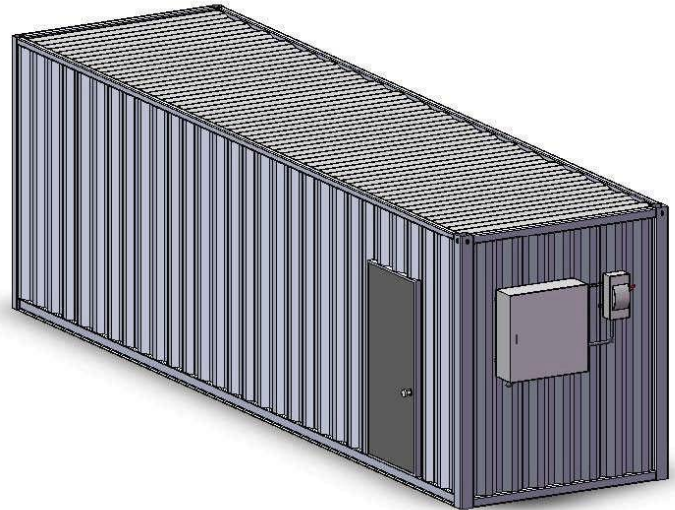
CONTAINER ENCLOSURES – CNTR SERIES

Application:

newterra Container Enclosures are a popular choice for housing large stationary systems. Containers are secure, cost effective and offer a wide range of options to customize appearance or functionality to suit customer requirements.

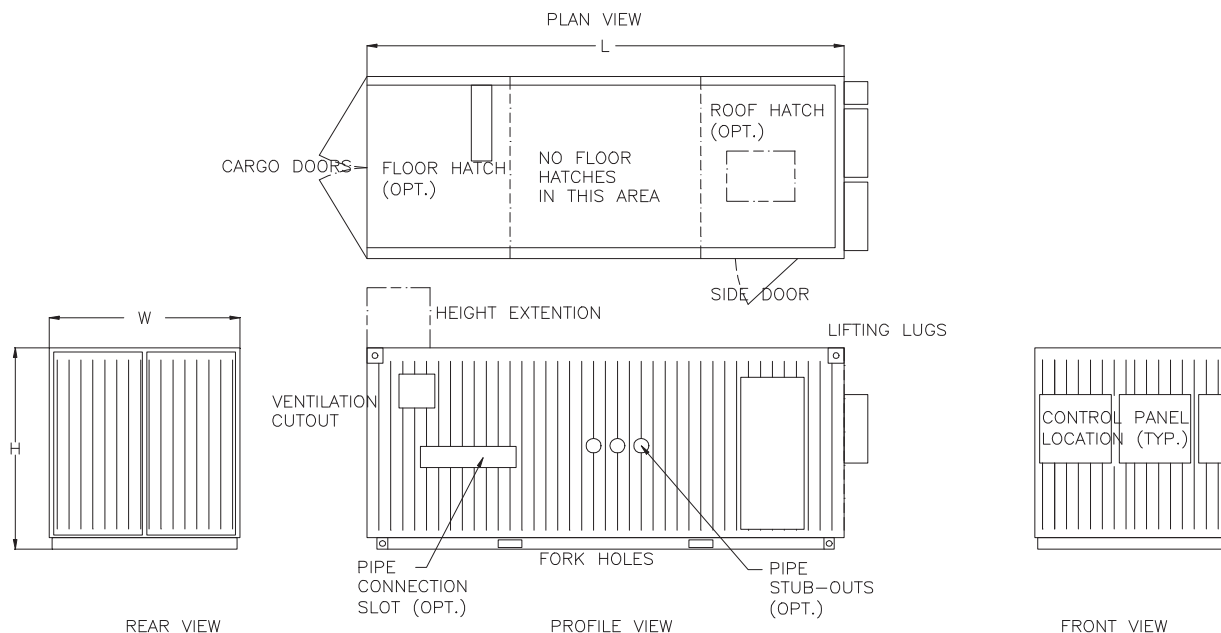
Constructions:

Heavy corrugated steel shell and steel beam structure with wood-plank flooring. Heavy steel double doors on one end are standard. Twenty-foot and forty-foot are standard length, but a custom length can be obtained by cutting one of the standard length units.



Standard Features:

- Painted exterior, plywood interior
- Waterproof sealed floor
- Double cargo doors on end (opening 89" H x 92" W); side door (32")
- Lifting lugs at roof for crane lifting; lifting lugs at base for boom/crane lifting fork holes in base (20ft only)



CONTAINER ENCLOSURES – CNTR SERIES

Dimension and Specification chart:

Part Number	Length	Width	Height	Weight Empty (lbs)	Std Cap. (lbs)	Interior Dimensions		
						Length	Width	Height
CNTR10	10'	8'	8' 6"	3,000	9,000	9' 8"	7' 8"	7' 10"
CNTR12	12'	8'	8' 6"	3,800	10,800	11' 8"	7' 8"	7' 10"
CNTR16	16'	8'	8' 6"	4,500	14,400	15' 5"	7' 8"	7' 10"
CNTR20	20'	8'	8' 6"	5,000	18,000	19' 4"	7' 8"	7' 10"
CNTR24	24'	8'	8' 6"	5,800	21,600	22' 4"	7' 8"	7' 10"
CNTR28	28'	8'	8' 6"	6,400	25,200	27' 4"	7' 8"	7' 10"
CNTR32	32'	8'	8' 6"	7,200	28,800	31' 4"	7' 8"	7' 10"
CNTR36	36'	8'	8' 6"	8,000	32,400	35' 4"	7' 8"	7' 10"
CNTR40	40'	8'	8' 6"	8,800	36,000	39' 4"	7' 8"	7' 10"

Options Table:

Option	Description
PE approval of structural drawings	Professional Engineer-stamped, wind-load hold-down documentation in compliance with local building code
Exterior Steel Siding	Industrial steel siding exterior
EPDM Roof	High-quality EPDM membrane roof
Process heat exchanger exhaust	Exhaust hatches can be inserted in wall to diffuse heat outside of building
Extra louver for added ventilation	For added ventilation and air circulation a louver can be installed into building wall
Sound Insulation	Layer of sound-insulation material built into walls blocks out operational noise
Rubber flooring	¾" thick rubber floor mats
Sump	2" sump in floor to detect flooding
Floor cutout	Floor hatch can be cutout to allow pipe entrance from underground
Roof extension or hatch	For tall equipment, roof extensions or hatches can be built into roof
Pipe stub outs	Pipe stub outs can be mounted on side of building
Pipe connection slot	Pipe-connection slot can be mounted on side of building
Ventilation Fan	Properly sized ventilation fan with thermostat
Heater	Properly sized heater with thermostat
Lighting	Proper lighting to allow for acceptable amount of light for work inside of the container
Thermal insulation	R7.2 insulation in walls and ceiling

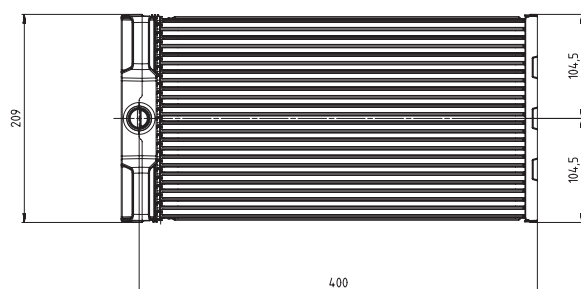
MicroClear®

Technical Data Sheet **CASSETTE FILTER MCXL2** Article-No. 80200072

Completely welded filter cassette for the filtration of water. Typical applications:

Waste Water in membrane bioreactors, surface water. The cassette consists of:

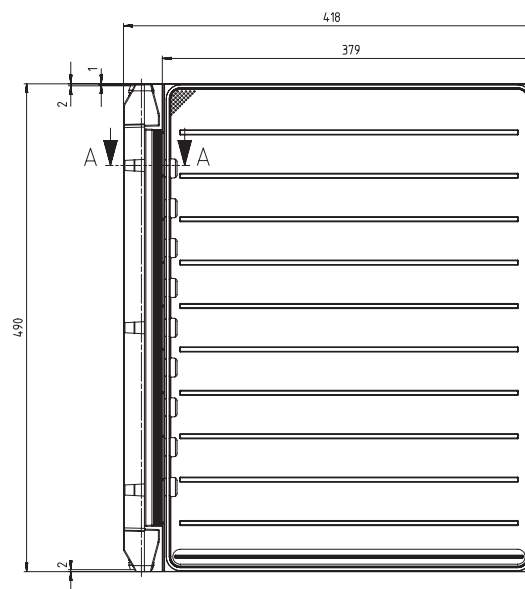
- housing and header made of polypropylene (FDA approved)
- 23 active filter plates made of polypropylene (FDA approved)
- 2 protective plates made of polypropylene (FDA approved)
- laser welded membrane made of Polyethersulfone (KTW approved)



Parameter	Unit	Value
dimension of filter housing (incl. flange for aeration)	L x W x H cm	209 x 418 x 490
outlet diameter	mm	25
protective plates		2
number of active plates		23
total membrane surface area	m ²	8
possible flow ¹	l/m ² h	
2 chemical cleanings/year		30
1 chemical cleaning/year		15
max. flow	l/m ² h	50
membrane material ²		PES/PVDF
pore size nom. ²	µm	0.04-0.3
filtration pressure	bar	0.1-0.25
backflush pressure	bar	0.07-0.1
filter housing material		PP
weight	kg	approx. 11.5

¹ depending on wastewater characteristics

² membrane material selectable for specified applications or customers

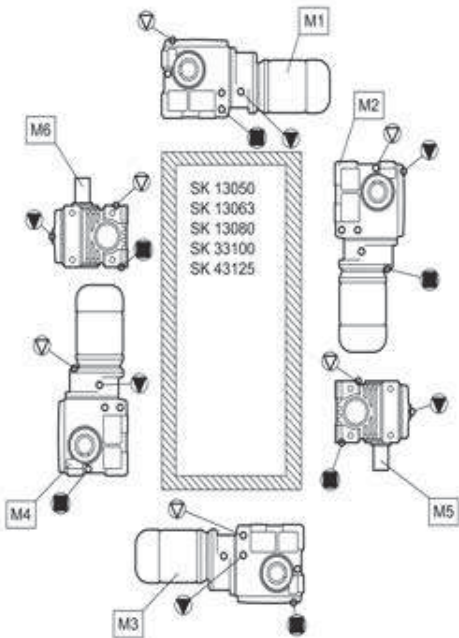
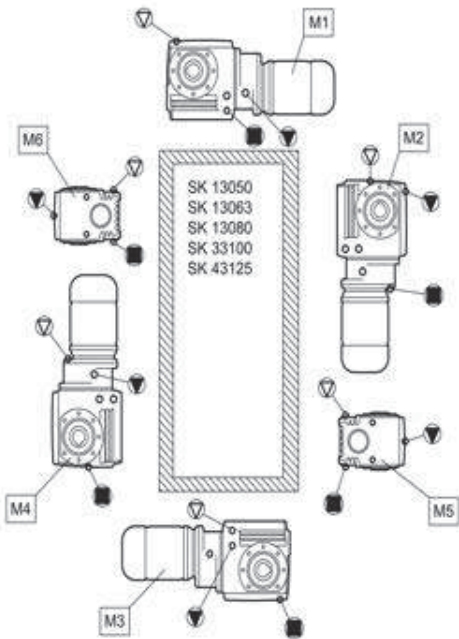


Revised: 13.01.2014

Design and specifications are subject to change without notice.

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6.2 Lubricants

With the exception of type SK 11282, SK 11382, SK 12382 and SK 9096.1 gear units, all gear units are filled with lubricant ready for operation in the required installation position when delivered. This initial filling corresponds to a lubricant from the column for the ambient temperatures (normal version) in the lubricant table.

Roller bearing greases


This table shows comparable roller bearing greases from various manufacturers. The manufacturer can be changed for a given grease type. Getriebebau NORD must be contacted in case of change of grease type or ambient temperature range, as otherwise no warranty for the functionality of our gear units can be accepted.

Lubricant type	Ambient temperature					
Mineral oil-based grease	-30 ... 60 °C	Tribol GR 100-2 PD	Renolit GP 2 Renolit LZR 2 H	-	Mobilux EP 2	Gadus S2 V100 2
	-50 ... 40 °C	Optitemp LG 2	Renolit WTF 2	-	-	-
Synthetic grease	-25 ... 80 °C	Tribol GR 4747/220-2 HAT	Renolit HLT 2 Renolit LST 2	PETAMO GHY 133 N Klüberplex BEM 41-132	Mobiltemp SHC 32	
Biodegradable grease	-25 ... 40 °C	-	Plantogel 2 S	Klüberbio M 72-82	Mobil SHC Grease 102 EAL	Naturelle Grease EP2

Table 5: Roller bearing greases

Lubricant table

This table shows comparable lubricants from various manufacturers. The manufacturer can be changed within a particular viscosity or lubricant type. Getriebebau NORD must be contacted in case of change of viscosity or lubricant type, as otherwise no warranty for the functionality of our gearboxes can be accepted.

Lubricant type	Details on type plate	DIN (ISO) / Ambient temperature						
Mineral oil	CLP 680	ISO VG 680 0...40 °C	Alpha EP 680 Alpha SP 680 Optigear BM 680 Optigear Synthetic 1100/680	Renolin CLP 680 Renolin CLP 680 Plus	Klüberoil GEM 1-680 N	Mobilgear 600 XP 680	Omala S2 G 680	Carter EP 680 Carter XEP 680
	CLP 220	ISO VG 220 -10...40 °C	Alpha EP 220 Alpha SP 220 Optigear BM 220 Optigear Synthetic 1100/220	Renolin CLP 220 Renolin CLP 220 Plus Renolin Gear 220 VCI	Klüberoil GEM 1-220 N	Mobilgear 600 XP 220	Omala S2 G 220	Carter EP 220 Carter XEP 220
	CLP 100	ISO VG 100 -15...25 °C	Alpha EP 100 Alpha SP 100 Optigear BM 100 Optigear Synthetic 1100/100	Renolin CLP 100 Renolin CLP 100 Plus	Klüberoil GEM 1-100 N	Mobilgear 600 XP 100	Omala S2 G 100	Carter EP 100
Synthetic oil (Polyglycol)	CLP PG 680	ISO VG 680 -20...40 °C	Alphasyn GS 680 Optigear Synthetic 800/680	Renolin PG 680	Klübersynth GH 6-680	Mobil Glygoyle 680	Omala S4 WE 680	Carter SY 680 Carter SG 680
	CLP PG 220	ISO VG 220 -25...80 °C	Alphasyn GS 220 Alphasyn PG 220 Optigear Synthetic 800/220	Renolin PG 220	Klübersynth GH 6-220	Mobil Glygoyle 220	Omala S4 WE 220	-
Synthetic oil (hydrocarbon)	CLP HC 460	ISO VG 460 -30...80 °C	Alphasyn EP 460 Optigear Synthetic PD 460	Renolin Unisyn CLP 460	Klübersynth GEM 4-460 N	Mobil SHC 634	Omala S4 GX 460	Carter SH 460
	CLP HC 220	ISO VG 220 -40...80 °C	Alphasyn EP 220 Optigear Synthetic PD 220	Renolin Unisyn CLP 220 Renolin Unisyn Gear VCI	Klübersynth GEM 4-220 N	Mobil SHC 630	Omala S4 GX 220	Carter SH 220
Bio-degradable oil	CLP E 680	ISO VG 680 -5...40 °C	-	Plantogear 680 S	-	-	-	-
	CLP E 220	ISO VG 220 -5...40 °C	Performance Bio GE 220 ESS Performance Bio GE 220 ESU	Plantogear 220 S	Klübersynth GEM 2-220	-	Naturelle Gear Fluid EP 220	-







Lubricant type	Details on type plate	DIN (ISO) / Ambient temperature						
Food grade oil	CLP PG H1 680	ISO VG 680 -5...40 °C	Optileb GT 1800/680	Cassida Fluid WG 680	Klübersynth UH1 6-680	Mobil Glygoyle 680		-
	CLP PG H1 220	ISO VG 220 -25...40 °C	Optileb GT 1800/200	Cassida Fluid WG 220	Klübersynth UH1 6-220	Mobil Glygoyle 220		Nevastane SY 220
	CLP HC H1 680	ISO VG 680 -5...40 °C	Optileb GT 680	Cassida Fluid GL 680	Klüberoil 4 UH1-680 N	-		-
	CLP PG H1 220	ISO VG 220 -25...40 °C	Optileb GT 220	Cassida Fluid GL 220	Klüberoil 4 UH1-220 N	Mobil SHC Cibus 220		Nevastane XSH 220
Gear unit fluid grease		-25 ... 60 °C	Tribol GR 100-00 PD Tribol GR 3020/1000-00 PD Spheerol EPL 00	Renolit Duraplex EP 00 Renolit LST 00	MICROLUBE GB 00 Klübersynth GE 46-1200	Mobil Chassis Grease LBZ Mobil Glygoyle Grease 00	Alvania EP(LF)2 -	Multis EP 00 Marson SY 00

Table 6: Lubricant table

6.3 Lubricant quantities

Information

Lubricants

After changing the lubricant, and in particular after the initial filling, the oil level may change during the first few hours of operation, as the oil galleries and the hollow spaces only fill gradually during operation.

The oil level is still within the permissible tolerance.

If at the express request of the customer, an oil inspection glass is installed at an additional charge, we recommend that the customer corrects the oil level after an operating period of approx. 2 hours, so that when the gear unit is at a standstill and has cooled down, the oil level is visible in the inspection glass. Only then, is it possible to check the oil level by means of the inspection glass.

The filling quantities stated in the following tables are for guidance only. The precise quantities vary depending on the exact gear ratio. When filling, always observe the oil level screw hole as an indicator of the precise quantity of oil.

* Gear unit types SK 11282, SK 11382, SK 11382.1, SK 12382 and SK 9096.1 are normally supplied without oil.

6.4 Helical gear unit





















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	M1	M2	M3	M4	M5	M6		M1	M2	M3	M4	M5	M6
⇒ 6.1 SK11E	0,25	0,50	0,65	0,50	0,40	0,40	⇒ 6.1 SK11E F	0,30	0,50	0,50	0,45	0,40	0,40
SK21E	0,60	1,20	1,30	1,00	1,00	1,00	SK21E F	0,50	1,20	1,30	0,60	0,90	0,90
SK31E	1,10	2,00	2,20	1,70	1,50	1,50	SK31E F	0,90	1,80	1,65	1,30	1,25	1,25
SK41E	1,60	2,80	3,30	2,80	2,30	2,30	SK41E F	1,20	2,30	2,70	2,00	1,90	1,90
SK51E	1,80	3,50	4,10	4,00	3,80	3,80	SK51E F	1,80	3,50	4,10	3,00	3,80	3,80
 [L]							 [L]						
	M1	M2	M3	M4	M5	M6		M1	M2	M3	M4	M5	M6
SK02	0,20	0,75	0,75	0,65	0,60	0,60	SK02 F	0,25	0,70	0,70	0,70	0,50	0,50
SK12	0,25	0,80	0,85	0,75	0,55	0,55	SK12 F	0,35	0,85	0,90	0,90	0,70	0,70
SK22	0,50	1,90	2,10	1,80	1,40	1,40	SK22 F	0,70	1,80	1,80	1,80	1,40	1,40
SK32	0,90	2,50	3,10	3,10	2,00	2,00	SK32 F	1,20	2,80	3,10	3,10	2,20	2,20
SK42	1,40	4,50	4,50	4,30	3,20	3,20	SK42 F	1,80	4,40	4,50	4,00	3,70	3,70
SK52	2,50	7,00	6,80	6,80	5,10	5,10	SK52 F	3,00	6,80	6,20	7,40	5,60	5,60
 [L]							 [L]						
	M1	M2	M3	M4	M5	M6		M1	M2	M3	M4	M5	M6
SK62	6,50	15,00	13,00	16,00	15,00	15,00	SK62 F	7,00	15,00	14,00	18,50	16,00	16,00
SK72	10,00	23,00	18,00	26,00	23,00	23,00	SK72 F	10,00	23,00	18,50	28,00	23,00	23,00
SK82	14,00	35,00	27,00	44,00	32,00	32,00	SK82 F	15,00	37,00	29,00	45,00	34,50	34,50
SK92	25,00	73,00	47,00	76,00	52,00	52,00	SK92 F	26,00	73,00	47,00	78,00	52,00	52,00
SK102	36,00	79,00	66,00	102,00	71,00	71,00	SK102 F	40,00	81,00	66,00	104,00	72,00	72,00
 [L]							 [L]						
	M1	M2	M3	M4	M5	M6		M1	M2	M3	M4	M5	M6
SK03	0,35	1,20	0,80	1,00	0,70	0,70	SK03 F	0,55	0,95	0,90	1,20	0,90	0,90
SK13	0,75	1,30	1,30	1,20	0,75	0,75	SK13 F	1,00	1,30	1,30	1,20	1,00	1,00
SK23	1,20	2,00	1,90	2,40	1,60	1,60	SK23 F	1,40	2,60	2,30	2,80	2,80	2,80
SK33N	1,75	3,00	3,40	4,00	2,30	2,30	SK33N F	2,20	3,00	3,40	4,20	2,30	2,30
SK43	3,00	5,60	5,20	6,60	3,60	3,60	SK43 F	3,50	5,70	5,00	6,10	4,10	4,10
SK53	4,50	8,70	7,70	8,70	6,00	6,00	SK53 F	5,20	8,40	7,00	8,90	6,70	6,70
 [L]							 [L]						
	M1	M2	M3	M4	M5	M6		M1	M2	M3	M4	M5	M6
SK63	13,00	14,50	14,50	16,00	13,00	13,00	SK63 F	13,50	14,00	15,50	18,00	14,00	14,00
SK73	20,50	20,00	22,50	27,00	20,00	20,00	SK73 F	22,00	22,50	23,00	27,50	20,00	20,00
SK83	30,00	31,00	34,00	37,00	33,00	33,00	SK83 F	31,00	34,00	35,00	40,00	34,00	34,00
SK93	53,00	70,00	59,00	72,00	49,00	49,00	SK93 F	53,00	70,00	59,00	74,00	49,00	49,00
SK103	74,00	71,00	74,00	97,00	67,00	67,00	SK103 F	69,00	78,00	78,00	99,00	67,00	67,00

Table 7: Lubricant quantities for helical gear units

NORDBLOC


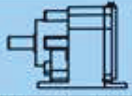

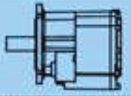



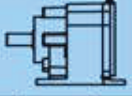

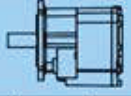



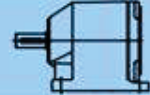




 [L]							 [L]						
 6.1	M1	M2	M3	M4	M5	M6	 6.1	M1	M2	M3	M4	M5	M6
SK072.1	0,16	0,32	0,21	0,23	0,18	0,20	SK072.1 F	0,16	0,32	0,21	0,23	0,18	0,20
SK172.1	0,27	0,59	0,42	0,45	0,32	0,39	SK172.1 F	0,27	0,59	0,42	0,45	0,32	0,39
SK372.1	0,45	1,05	0,75	1,00	0,60	0,65	SK372.1 F	0,45	1,05	0,75	1,00	0,60	0,65
SK572.1	0,75	1,90	1,50	2,00	1,10	1,15	SK572.1 F	0,75	1,90	1,50	2,00	1,10	1,15
SK672.1	1,10	2,60	2,15	2,70	1,55	1,65	SK672.1 F	1,10	2,60	2,15	2,70	1,55	1,65
SK772.1	1,30	3,80	2,40	3,20	1,60	2,50	SK772.1 F	1,30	3,80	2,40	3,30	1,70	2,40
SK872.1	2,90	7,80	4,60	6,40	2,50	4,00	SK872.1 F	3,20	7,50	5,10	6,70	2,60	4,30
SK972.1	4,50	12,00	7,50	11,50	4,20	7,50	SK972.1 F	4,50	12,50	8,00	12,50	4,50	7,70
SK772.1VL	2,00	3,80	2,40	3,20	1,60	2,50	SK772.1VL F	2,00	3,80	2,40	3,30	1,70	2,40
SK872.1VL	5,00	7,80	4,60	6,40	2,50	4,00	SK872.1VL F	5,00	7,50	5,10	6,70	2,60	4,30
SK972.1VL	8,50	12,00	7,50	11,50	4,20	7,50	SK972.1VL F	8,50	12,50	8,00	12,50	4,50	7,70
 [L]							 [L]						
SK373.1	0,45	1,05	0,75	1,00	0,60	0,65	SK373.1 F	0,45	1,05	0,75	1,00	0,60	0,65
SK573.1	0,75	1,90	1,50	2,00	1,10	1,15	SK573.1 F	0,75	1,90	1,50	2,00	1,10	1,15
SK673.1	1,10	2,60	2,15	2,70	1,55	1,65	SK673.1 F	1,10	2,60	2,15	2,70	1,55	1,65
SK773.1	2,30	3,80	3,30	3,20	2,40	3,10	SK773.1 F	2,00	3,50	3,20	2,90	2,30	3,00
SK873.1	4,20	7,80	5,90	6,40	4,10	5,90	SK873.1 F	4,10	7,60	6,90	6,60	5,00	6,60
SK973.1	7,50	12,00	10,50	11,50	7,50	10,50	SK973.1 F	7,40	12,20	11,10	11,60	8,00	10,90
SK773.1VL	2,30	3,80	3,30	3,20	2,40	3,10	SK773.1VL F	2,00	3,50	3,20	2,90	2,30	3,00
SK873.1VL	4,20	7,80	5,90	6,40	4,10	5,90	SK873.1VL F	4,10	7,60	6,90	6,60	5,00	6,60
SK973.1VL	7,50	12,00	10,50	11,50	7,50	10,50	SK973.1VL F	7,40	12,20	11,10	11,60	8,00	10,90
 [L]													
SK071.1/071.1F	0,18	0,40	0,38	0,40	0,30	0,30							
SK171.1/171.1F	0,22	0,40	0,36	0,40	0,33	0,33							
SK371.1/371.1F	0,35	0,58	0,55	0,58	0,49	0,49							
SK571.1/571.1F	0,48	0,86	0,80	0,92	0,68	0,68							
SK771.1/771.1F	0,90	1,50	1,20	1,70	1,16	1,16							

Table 8: Lubricant quantities for NORDBLOC

NORDBLOC helical gear units

 [L]							 [L]						
⇒  6.1	M1	M2	M3	M4	M5	M6	⇒  6.1	M1	M2	M3	M4	M5	M6
SK172	0,35	0,50	0,50	0,50	0,50	0,50	SK172 F	0,35	0,50	0,50	0,50	0,50	0,50
SK272	0,60	1,00	1,00	1,00	1,00	1,00	SK272 F	0,60	1,00	1,00	1,00	1,00	1,00
SK372	0,60	1,00	1,00	1,00	1,00	1,00	SK372 F	0,60	1,00	1,00	1,00	1,00	1,00
SK472	1,00	1,90	1,90	2,00	1,80	1,80	SK472 F	1,00	1,90	1,90	1,90	1,90	1,50
SK572	1,00	1,90	1,90	2,00	1,80	1,80	SK572 F	1,00	1,90	1,90	1,90	1,90	1,50
SK672	1,40	3,40	3,10	3,15	1,45	3,15	SK672 F	1,15	3,40	2,70	2,80	1,25	2,70
SK772	2,00	3,30	3,50	4,20	2,70	3,30	SK772 F	1,60	3,30	3,50	3,30	3,10	3,10
SK872	3,70	9,60	9,10	7,30	4,70	8,00	SK872 F	3,50	9,00	7,90	7,70	3,90	7,20
SK972	6,50	16,00	15,70	14,70	8,50	14,00	SK972 F	6,50	15,00	13,00	13,50	6,50	12,00


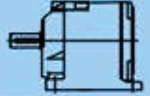

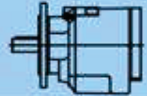
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SK273	0,62	1,10	1,10	1,10	1,10	1,10	SK273 F	0,62	1,10	1,10	1,10	1,10	1,10
SK373	0,55	1,10	1,10	1,10	1,10	1,10	SK373 F	0,55	1,10	1,10	1,10	1,10	1,10
SK473	1,30	2,50	2,10	2,40	2,10	2,10	SK473 F	1,25	2,40	2,10	2,50	2,10	2,10
SK573	1,30	2,50	2,10	2,40	2,10	2,10	SK573 F	1,25	2,40	2,10	2,50	2,10	2,10
SK673	1,80	3,80	3,20	3,40	2,90	3,00	SK673 F	1,70	3,80	3,00	3,20	3,00	3,00
SK773	2,50	4,50	3,70	4,60	3,30	3,30	SK773 F	2,30	5,00	3,60	4,50	3,90	3,90
SK873	6,20	8,40	7,50	9,10	7,50	7,50	SK873 F	5,00	8,80	7,60	8,00	8,00	8,00
SK973	11,00	15,80	13,00	16,00	13,30	13,00	SK973 F	10,30	16,50	13,00	16,00	14,00	14,00

Table 9: Lubricant quantities for NORDBLOC helical gear units

Standard helical gear units




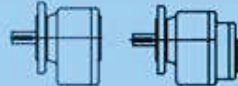

















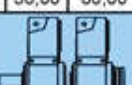


 [L]							 [L]						
 6.1	M1	M2	M3	M4	M5	M6	 6.1	M1	M2	M3	M4	M5	M6
SK20	0,55	1,00	0,55	1,00	0,55	0,55	SK20 F	0,35	0,60	0,35	0,60	0,35	0,35
SK0	0,13	0,22	0,13	0,22	0,13	0,13	SK0 F	0,13	0,22	0,13	0,22	0,13	0,13
SK01	0,22	0,38	0,22	0,38	0,22	0,22	SK01 F	0,22	0,38	0,22	0,38	0,22	0,22
SK25	0,50	1,00	0,50	1,00	0,50	0,50	SK25 F	0,50	1,00	0,50	1,00	0,50	0,50
SK33	1,00	1,60	1,00	1,60	1,00	1,00	SK33 F	1,00	1,50	1,00	1,50	1,00	1,00
SK30	0,90	1,30	0,90	1,30	0,90	0,90	SK30 F	0,70	1,10	0,70	1,10	0,70	0,70
SK300	1,20	2,00	1,20	2,00	1,20	1,20	SK300 F	1,25	1,50	1,20	1,80	1,30	0,95
SK330	1,80	2,80	1,80	2,80	1,80	1,80	SK330 F	1,60	2,50	1,60	2,90	1,90	1,40
SK200	0,80	1,30	0,80	1,30	0,80	0,80	SK200 F	0,65	0,95	0,70	1,10	0,80	0,50
SK010	0,38	0,60	0,38	0,60	0,38	0,38	SK010 F	0,35	0,65	0,40	0,74	0,50	0,30
SK250	1,20	1,50	1,20	1,50	1,20	1,20	SK250 F	0,90	1,40	1,00	1,60	1,30	0,80
SK000	0,24	0,40	0,24	0,41	0,24	0,24	SK000 F	0,24	0,41	0,24	0,41	0,24	0,24

Table 10: Lubricant quantities for standard helical gear units


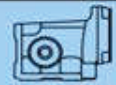







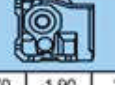






Parallel shaft gear units

 [L]							 [L]								
	⇒  6.1	M1	M2	M3	M4	M5		M6	⇒  6.1	M1	M2	M3	M4	M5	M6
	SK0182NB A	0,40	0,55	0,55	0,40	0,40	0,40								
	SK0282NB A	0,70	1,10	0,80	1,10	0,90	0,90								
								SK1382NB A	1,40	2,30	2,20	2,20	2,00	2,00	
 [L]							 [L]								
	SK1282 A	0,95	1,30	0,90	1,30	1,00	1,00	SK2382 A	2,30	2,70	2,10	3,20	2,00	2,00	
	SK2282 A	1,70	2,30	1,70	2,20	1,90	1,90	SK3382 A	3,80	4,30	3,00	5,50	3,00	3,00	
	SK3282 A	2,80	4,00	3,30	3,80	3,00	3,00	SK4382 A	6,10	6,90	4,90	8,40	5,00	5,00	
	SK4282 A	4,20	5,40	4,40	5,00	4,20	4,20	SK5382 A	12,50	12,00	6,70	14,00	8,30	8,30	
	SK5282 A	7,50	8,80	7,50	8,80	7,20	7,20	SK1382 A	1,45	1,60	1,15	1,70	1,10	1,10	
 [L]							 [L]								
	SK6282 A	17,00	15,50	12,50	17,50	11,00	14,00	SK6382 A	16,00	13,00	10,00	18,00	14,00	12,50	
	SK7282 A	25,50	21,00	20,50	27,00	16,00	21,00	SK7382 A	22,00	21,00	16,00	25,00	23,00	22,00	
	SK8282 A	37,50	33,00	30,50	44,00	31,00	31,00	SK8382 A	34,50	32,50	25,00	38,00	35,00	30,00	
	SK9282 A	74,50	70,00	56,00	80,00	65,00	59,00	SK9382 A	73,50	70,00	43,00	74,50	65,00	60,00	
 [L]							 [L]								
	SK10282 A	90	90	40	90	60	82	SK10382 A	85	90	73	100	80	80	
	SK11282 A	165	160	145	195	100	140	SK11382 A	160	155	140	210	155	135	
								SK12382 A	160	155	140	210	155	135	
								SK10382.1 A	76,0	80,0	71,0	92,5	71,5	66,5	
								SK11382.1 A	127	133	118	194	124	112	

* For further information see page 58

Table 11: Lubricant quantities for parallel shaft gear units

Bevel gear units

 [L] 6.1							 [L] 6.1						
	M1	M2	M3	M4	M5	M6		M1	M2	M3	M4	M5	M6
SK92072	0,40	0,60	0,50	0,55	0,40	0,40	SK92072 A	0,40	0,60	0,55	0,55	0,40	0,40
SK92172	0,60	0,90	1,00	1,10	1,10	0,80	SK92172 A	0,50	1,00	0,90	1,05	0,90	0,60
SK92372	0,90	1,60	1,50	1,90	1,50	0,90	SK92372 A	1,20	1,60	1,50	1,90	1,30	1,30
SK92672	1,80	3,50	3,60	3,40	2,60	2,60	SK92672 A	1,60	2,80	2,50	3,30	2,40	2,40
SK92772	2,30	4,50	4,60	5,30	4,10	4,10	SK92772 A	2,80	4,40	4,50	5,50	3,50	3,50
 [L] 6.1							 [L] 6.1						
	M1	M2	M3	M4	M5	M6		M1	M2	M3	M4	M5	M6
SK92072.1	0,26	0,49	0,42	0,54	0,29	0,31	SK93072.1	0,39	0,93	0,79	1,02	0,49	0,62
SK92172.1	0,34	0,61	0,52	0,67	0,42	0,48	SK93172.1	0,60	1,17	0,94	1,22	0,65	0,85
SK92372.1	0,43	0,92	0,73	0,83	0,55	0,61	SK93372.1	1,00	1,97	1,65	2,14	1,12	1,34
SK92672.1	0,85	1,60	1,20	1,50	1,02	1,02	SK93672.1	1,80	3,23	2,71	3,80	2,02	2,45
SK92772.1	1,30	2,65	1,86	2,45	1,60	1,60	SK93772.1	2,72	4,63	3,70	5,40	2,93	3,25
SK920072.1	0,21	0,47	0,36	0,34	0,28	0,28	SK930072.1	0,28	0,65	0,56	0,54	0,39	0,39
 [L] 6.1							 [L] 6.1						
	M1	M2	M3	M4	M5	M6		M1	M2	M3	M4	M5	M6
SK9012.1	0,70	1,70	1,90	2,10	1,10	1,50	SK9012.1 A	1,00	1,90	1,90	2,20	1,20	1,70
SK9016.1	0,70	1,70	1,90	2,10	1,10	1,50	SK9016.1 A	1,00	1,90	1,90	2,20	1,20	1,70
SK9022.1	1,30	2,90	3,30	3,80	1,70	2,80	SK9022.1 A	1,60	3,50	3,50	4,20	2,30	2,80
SK9032.1	1,80	5,40	6,10	6,80	3,00	4,60	SK9032.1 A	2,10	4,80	6,40	7,10	3,30	5,10
SK9042.1	4,40	9,00	10,00	10,70	5,20	7,70	SK9042.1 A	4,50	10,00	10,00	11,50	6,50	8,20
SK9052.1	6,50	16,00	19,00	21,50	11,00	15,50	SK9052.1 A	7,50	16,50	20,00	23,50	11,50	18,00
SK9062.1	10,00	27,50	32,00	36,00	18,00	24,00	SK9062.1 A	12,00	27,50	33,00	38,50	19,00	26,00
SK9072.1	10,00	27,50	32,00	36,00	18,00	24,00	SK9072.1 A	12,00	27,50	33,00	38,50	19,00	26,00
SK9082.1	17,00	51,50	62,50	71,50	33,00	46,50	SK9082.1 A	21,00	54,00	66,00	80,00	38,00	52,00
SK9086.1	29,00	73,00	85,00	102,00	48,00	62,00	SK9086.1 A	36,00	78,00	91,00	107,00	53,00	76,00
SK9092.1	41,00	157,00	170,00	172,00	80,00	90,00	SK9092.1 A	40,00	130,00	154,00	175,00	82,00	91,00
SK9096.1	70,00	187,00	194,00	254,00	109,00	152,00	SK9096.1 A	80,00	187,00	193,00	257,00	113,00	156,00
 [L] 6.1							 [L] 6.1						
	M1	M2	M3	M4	M5	M6		M1	M2	M3	M4	M5	M6
SK9013.1	1,35	2,10	2,15	2,75	1,00	1,80	SK9013.1 A	1,45	2,30	2,10	2,80	1,05	1,80
SK9017.1	1,30	2,00	2,10	2,70	1,00	1,70	SK9017.1 A	1,45	2,30	2,10	2,80	1,05	1,80
SK9023.1	2,20	3,20	3,60	4,70	2,20	2,90	SK9023.1 A	2,30	3,50	3,80	5,30	2,20	3,40
SK9033.1	3,10	5,70	6,30	8,00	3,40	4,80	SK9033.1 A	3,70	5,70	6,70	8,60	3,60	5,30
SK9043.1	5,00	10,10	11,00	13,30	5,70	8,10	SK9043.1 A	6,50	10,50	11,90	14,70	6,70	9,30
SK9053.1	10,00	17,00	20,00	24,50	11,50	16,50	SK9053.1 A	13,00	18,00	21,50	26,50	13,00	17,00

* For further information see page 58

Table 12: Lubricant quantities for bevel gear units

Helical worm gear units






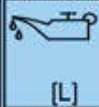



 [L]							 [L]							 [L]						
⇒ 6.1																				
	M1	M2	M3	M4	M5	M6		M1	M2	M3	M4	M5	M6		M1	M2	M3	M4	M5	M6
SK02040	0,40	0,80	0,75	0,65	0,50	0,50	SK02040 A	0,40	0,70	0,65	0,65	0,55	0,55	SK02040 A	0,45	1,40	1,15	1,10	0,75	0,75
SK02050	0,40	1,40	1,10	1,30	0,70	0,70	SK02050 A	0,45	1,40	1,15	1,10	0,75	0,75	SK02050 A	0,45	1,40	1,15	1,10	0,75	0,75
SK12063	0,60	1,80	1,20	1,60	1,00	1,00	SK12063 A	0,55	1,45	1,60	1,60	1,10	1,10	SK12063 A	0,55	1,45	1,60	1,60	1,10	1,10
SK12080	0,90	3,10	2,40	3,00	1,80	1,80	SK12080 A	0,80	3,10	3,20	2,80	1,80	1,80	SK12080 A	0,80	3,10	3,20	2,80	1,80	1,80
SK32100	1,50	6,30	5,60	5,50	3,60	3,60	SK32100 A	1,50	5,60	5,60	5,30	4,00	4,00	SK32100 A	1,50	5,60	5,60	5,30	4,00	4,00
SK42125	2,80	11,80	10,20	10,00	6,20	6,20	SK42125 A	3,00	12,50	10,80	10,80	6,50	6,50	SK42125 A	3,00	12,50	10,80	10,80	6,50	6,50
 [L]							 [L]							 [L]						
SK13050	0,75	1,75	1,30	1,75	0,75	0,75	SK13050 A	0,90	1,80	1,30	1,65	1,30	1,30	SK13050 A	0,90	1,80	1,30	1,65	1,30	1,30
SK13063	1,00	2,30	1,50	2,20	1,10	1,10	SK13063 A	1,05	2,10	1,80	2,10	1,40	1,40	SK13063 A	1,05	2,10	1,80	2,10	1,40	1,40
SK13080	1,70	3,50	3,50	3,50	2,00	2,00	SK13080 A	1,60	3,60	2,90	3,75	2,00	2,00	SK13080 A	1,60	3,60	2,90	3,75	2,00	2,00
SK33100	2,40	6,40	5,40	6,50	3,40	3,40	SK33100 A	2,60	6,00	5,80	6,00	3,50	3,50	SK33100 A	2,60	6,00	5,80	6,00	3,50	3,50
SK43125	4,25	13,00	10,50	13,50	7,20	7,20	SK43125 A	4,60	13,60	11,40	14,30	7,60	7,60	SK43125 A	4,60	13,60	11,40	14,30	7,60	7,60
 [L]							 [L]							 [L]						
SK02040 F	0,40	0,70	0,65	0,65	0,55	0,55	SK13050 F	0,75	1,80	1,50	1,70	1,05	0,90	SK13050 F	0,75	1,80	1,50	1,70	1,05	0,90
SK02050 F	0,40	1,50	1,25	1,20	0,90	0,75	SK13063 F	1,00	2,30	1,90	2,20	1,35	1,10	SK13063 F	1,00	2,30	1,90	2,20	1,35	1,10
SK12063 F	0,50	1,95	1,70	1,75	1,20	0,95	SK13080 F	1,60	3,80	3,50	3,90	2,70	2,50	SK13080 F	1,60	3,80	3,50	3,90	2,70	2,50
SK12080 F	0,90	3,70	3,20	3,40	2,50	2,30	SK33100 F	2,65	7,20	6,40	7,60	4,30	3,80	SK33100 F	2,65	7,20	6,40	7,60	4,30	3,80
SK32100 F	1,40	6,30	6,10	6,10	4,00	3,60	SK43125 F	4,70	15,00	13,00	16,00	9,00	7,70	SK43125 F	4,70	15,00	13,00	16,00	9,00	7,70
SK42125 F	3,00	11,50	11,50	11,00	8,40	7,30														

Table 13: Lubricant quantities for Helical worm gear units

6.5 Torque values

Dimensions	Bolt Torques [Nm]					
	Screw connections in the strength classes			Cover screws	Threaded pin on coupling	Screw connections on protective covers
	8.8	10.9	12.9			
M4	3.2	5	6	-	-	-
M5	6.4	9	11	-	2	-
M6	11	16	19	-	-	6.4
M8	27	39	46	11	10	11
M10	53	78	91	11	17	27
M12	92	135	155	27	40	53
M16	230	335	390	35	-	92
M20	460	660	770	-	-	230
M24	790	1150	1300	80	-	460
M30	1600	2250	2650	170	-	-
M36	2780	3910	4710	-	-	1600
M42	4470	6290	7540	-	-	-
M48	6140	8640	16610	-	-	-
M56	9840	13850	24130	-	-	-
G½	-	-	-	75	-	-
G¾	-	-	-	110	-	-
G1	-	-	-	190	-	-
G1¼	-	-	-	240	-	-
G1½	-	-	-	300	-	-

Table 14: Torque values

Assembling the hose fittings

Oil the thread of the union nut, the cutting ring and the screw neck. Tighten the union nut with the wrench until the point where the union nut can only be turned with considerably more force. Turn the union nut of the screw fitting approx. 30° to 60° further but not more than 90°. For this the screw neck must be held with a wrench. Remove excess oil from the screw fitting

6.6 Troubleshooting



WARNING

Injury to persons

There is a slipping hazard in case of leaks.

Clean the soiled floor and machine components before starting troubleshooting.



WARNING

Injury to persons

Risk of injury due to rapidly rotating and hot machine components.

Troubleshooting must only be performed when gear units are at a standstill and have cooled down. The drive must be isolated and secured to prevent accidental start-up.

NOTICE

Gear unit damage

Damage to the gear unit is possible in case of faults.

Shut down the drive unit immediately in case of any faults in the gear unit.

Gear unit malfunctions		
Fault	Possible cause	Remedy
Unusual running noises, vibrations	Oil too low or bearing damage or gear wheel damage	Consult NORD Service
Oil escaping from the gear unit or motor	Defective seal	Consult NORD Service
Oil escaping from pressure vent	Incorrect oil level or incorrect, contaminated oil or unfavourable operating conditions	Oil change, use oil expansion tank (Option OA)
Gear unit becomes too hot	Unfavourable installation conditions or gear unit damage	Consult NORD Service
Shock when switching on, vibrations	Defective motor coupling or loose gear unit mounting or defective rubber element	Replace elastomer gear rim, tighten motor and gear unit fastening bolts, replace rubber element
Output shaft does not rotate although motor is running	Fracture in gear unit or defective motor coupling or shrink disc slippage	Consult NORD Service

Table 15: Overview of malfunctions

6.7 Leaks and seals

Gear units are filled with oil or grease to lubricate the moving parts. Seals prevent the escape of lubricants. A complete seal is not technically possible, as a certain film of moisture, for example on the radial shaft sealing rings is normal and advantageous for a long-term seal. In the region of vents, moisture due to oil may be visible due to the escape of oil mist because of the function. In the case of grease-lubricated labyrinth seals, e.g. Taconite sealing systems, used grease emerges from the sealing gap due to the principle of operation. This apparent leak is not a fault.

According to the test conditions as per DIN 3761, the leak is determined by the medium which is to be sealed, which in test bench tests exceeds the function-related moisture in a defined test period and which results in dripping of the medium which is to be sealed. The measured quantity which is then collected is designated as leakage.

Definition of leakage according to DIN 3761 and its appropriate use					
Term	Explanation	Shaft sealing ring	Location of leak		
			in IEC adapter	Housing joint	Venting
Sealed	No moisture apparent	No reason for complaint	No reason for complaint	No reason for complaint	No reason for complaint
Damp	Moisture film locally restricted (not an area)	No reason for complaint	No reason for complaint	No reason for complaint	No reason for complaint
Wet	Moisture film beyond the extent of the component	No reason for complaint	No reason for complaint	Repair if necessary	No reason for complaint
Measurable leakage	Recognisable stream, dripping	Repair recommended	Repair recommended	Repair recommended	Repair recommended
Temporary leakage	Temporary malfunction of the sealing system or oil leak due to transport *)	No reason for complaint	No reason for complaint	Repair if necessary	No reason for complaint
Apparent leakage	Apparent leakage, e.g. due to soiling, sealing systems which can be re-lubricated	No reason for complaint	No reason for complaint	No reason for complaint	No reason for complaint

Table 16: Definition of leaks according to DIN 3761

*) Previous experience has shown that moist or wet radial shaft sealing rings stop leaking later. Therefore, under no circumstances can replacement be recommended at this stage. The reason for momentary moisture may be e.g. small particles under the sealing lip.

6.8 Repair information

For enquiries to our technical and mechanical service departments, please have the precise gear unit type (type plate) and if necessary the order number (type plate) to hand.

6.8.1 Repairs

The device must be sent to the following address if it needs repairing:

Getriebebau NORD GmbH & Co. KG
Service Department
 Getriebebau-Nord-Straße 1
 22941 Bargteheide

No guarantee can be given for any attachments, such as encoders or external fans, if a gear unit or geared motor is sent for repair.

Please remove all non-original parts from the gear unit or geared motor.



Information

Reason for return

If possible, the reason for returning the component or device should be stated. If necessary, at least one contact should be stated in case of queries.

This is important in order to keep repair times as short and efficient as possible.

6.8.2 Internet information

In addition, the country-specific operating and installation instructions in the available languages can be found on our Internet site: www.nord.com

6.9 Abbreviations

2D	Dust explosion protected gear units zone 21	FA	Axial force
2G	Explosion protected gear units with ignition protection class "c"	IE1	Motors with standard efficiency
3D	Dust explosion protected gear units zone 22	IE2	Motors with high efficiency
ATEX	AT mospheres EX plosibles	IEC	International Electrotechnical Commission
B5	Flange fastening with through holes	NEMA	National Electrical Manufacturers Association
B14	Flange fastening with threaded holes	IP55	International Protection
CW	Clockwise, right-hand direction of rotation	ISO	International Standardisation Organisation
CCW	Counter-clockwise, left-hand direction of rotation	pH	pH value
°dH	Water hardness in German hardness degrees: 1°dH = 0.1783 mmol/l	PPE	Personal Protective Equipment
DIN	German standards institute	RL	Directive
EC	European Community	VCI	Volatile Corrosion Inhibitor
EN	European standard	WN	Getriebebau NORD factory standard
FR	Radial transverse force		

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E-1347

TNK-101/2 - Tank, Closed Top, Cylindrical, 2100 gal, Norwesco - no drain, PN 40241
TNK-901 - Tank, Closed Top, Cylindrical, 2100 gal, Norwesco - no drain, PN 40241



Liquid Storage Tanks

Think Tanks. Think Norwesco.

2004 Edition



NORWESCO tanks are manufactured to strict quality guidelines to ensure years of high-performance use. Rugged, impact-resistant, one-piece seamless polyethylene construction makes our tanks suitable for the storage and/or transport of most liquid fertilizers, herbicides, insecticides and fungicides as well as a wide range of industrial chemicals. NORWESCO tanks are manufactured using resins that meet FDA specifications to ensure safe storage of potable water.

Quality, price, product line and leading edge technology make NORWESCO North America's largest manufacturer of rotationally molded tanks. Standard NORWESCO tanks will be delivered to you with a fitting installed when applicable. NORWESCO tanks may be ordered without a fitting as well.

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Vertical Storage Tanks

Vertical storage tanks are most frequently used for bulk storage and mobile nursing applications. NORWESCO vertical tanks feature tie-down slots, built-in graduated gallon indicators, an offset fill-well and a self-vented, slosh-proof lid.

All NORWESCO vertical tanks are equipped with an outlet fitting and siphon tube.

Gallon Capacity	Diameter	Height	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White	Heavy Weight Part No. Blue
25 ∞	18"	29"	5"	3/4"	41867	—
50 ∞	18"	53"	5"	3/4"	41865	—
65 ∞	23"	42"	8"	1 1/4"	45192	—
75	23"	50"	8"	1 1/4"	41863	—
100	28"	43"	8"	1 1/4"	41861	—
105	23"	63"	8"	2"	40803	—
150	30"	56"	8"	1 1/4"	41859	—
165	31"	55"	16"	2"	40281	—
200	30"	72"	8"	2"	41856	—
210	31"	69"	16"	2"	47401	—
250	30"	89"	8"	2"	41854	—
300	36"	78"	16"	2"	40213	—
305	46"	49"	16"	2"	40302	—
500	48"	72"	16"	2"	40148	40150
550	67"	42"	16"	2"	40023	—
750	48"	102"	16"	2"	40606	—
1000	64"	79"	16"	2"	40152	40154
1100	87"	51"	16"	2"	40070	40081
1350	71"	87"	16"	2"	40861	—
1500	64"	115"	16"	2"	40144	40146
1550	87"	65"	16"	2"	40235	40236
1700	87"	72"	16"	2"	40010	40012
2100	87"	87"	16"	2"	40178	40241
2100	102"	69"	16"	2"	41399	—
2500	95"	89"	16"	2"	40051	40052
3000	95"	107"	16"	2"	40754	40755
4000	102"	125"	16"	3 1/2"	40312	—
4200	102"	131"	16"	2"	41403	—
5000	102"	152"	16"	3 1/2"	40164	40166
5800	141"	97"	16"	3 1/2"	40071	—
6000	102"	182"	16"	3 1/2"	40226	40233
6100	120"	139"	16"	3 1/2"	40659	40661
6500	120"	150"	16"	3 1/2"	40224	40232
7800	120"	176"	16"	3 1/2"	40663	40665
9000	141"	146"	16"	3 1/2"	40543	40231
10000	141"	160"	16"	3 1/2"	40545	40353
12000	141"	192"	16"	3" *	40539	40541
15000	141"	244"	16"	3" *	41334	41336

∞ Within UPS dimensional limits

*316 Stainless Steel Bolted Fitting

Horizontal Leg Tanks

With the broadest leg tank line available, NORWESCO manufactures a size that will fit your needs. Used primarily for transport and nursing applications, NORWESCO'S leg tanks feature molded-in legs that act as "baffles" to reduce sloshing. Please refer to page 4 for support bands.

Gallon Capacity	Diameter	Length	Fill Opening	Outlet/Drain Specification	No. of Bands	Premium Weight Part No. White	Heavy Weight Part No. Blue
35 ∞	20"	29"	5"	3/4"	2 optional	45223	—
55 ∞	23"	33"	5"	3/4"	2 optional	41873	—
65 ∞	23"	43"	5"	3/4"	2 optional	45191	—
125	32"	41"	8"	2"	2 optional	40298	—
225	38"	49"	8"	2"	2 optional	40299	—
325	38"	68"	16"	2"	2 optional	40217	—
525	49"	71"	16"	2"	2 optional	40181	40193
725 *	49"	101"	16"	2"	3 required	40180	40194
1025 *	49"	139"	16"	2"	4 required	40089	40131
1325 *	66"	99"	16"	2"	4 required	41875	41877
5025 *	92"	190"	16" **	3"/2"	4 required	41879	41881

∞ Within UPS dimensional limits

*Require full length support and bands

**16" hinged lid



325 Gallon Horizontal Leg



1025 Gallon Horizontal Leg



Sloped For Complete Drainage **▲ 1010 Gallon Drainable Leg**

Drainable Leg Tanks

When complete drainage is necessary, these are the tanks of choice. They are designed primarily for use on fertilizer and chemical nurse trailers. All NORWESCO drainable tanks require full length bottom support as well as support bands. Please refer to page 4 for support bands.

Gallon Capacity	Width	Height	Length	Fill Opening	Outlet/Drain Specification	No. of Bands	Premium Weight Part No. White	Heavy Weight Part No. Blue
710 (horizontal)	47"	47"	104"	16"	2"	3 required	40655	40657
1010 (horizontal)	47"	47"	140"	16"	2"	4 required	40393	40395
1310 (horizontal)	66"	76"	99"	16"	—	4 required	41871	41872
1610 (elliptical)	69"	63"	140"	16"	—	4 required	40806	40808
2610 (elliptical)	90"	70"	140"	16"*	—	4 required	41382	41383
3210 (elliptical)	92"	74"	178"	16"*	—	4 required	40822	40824

*16" hinged lid

Elliptical Leg Tanks

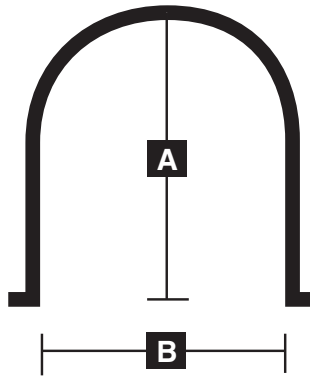
This elliptical tank style is designed to provide the greatest capacity with the lowest center of gravity, making it the best design available for transporting larger volumes. NORWESCO elliptical tanks feature molded-in legs and flow-through baffles which work together to reduce sloshing and provide increased stability during transport. All NORWESCO elliptical leg tanks require full length bottom support as well as support bands. Please refer to page 4 for support bands.

Gallon Capacity	Width	Height	Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White	Heavy Weight Part No. Blue
1035	79"	53"	89"	16"	2"	40191	—
1235	65"	52"	128"	16"	2"	40239	—
1635	71"	57"	142"	16"	2"	40387	40388
2035	84"	55"	142"	16"	2"	40618	40623
2635	90"	71"	140"	16"	3"/2"	40547	40283
3135	88"	76"	151"	16"	3"/2"	40686	40688
4035	92"	77"	192"	16" *	3"/2"	41267	41269

*16" hinged lid



2035 Gallon Elliptical Leg



Steel Supports and Accessories

NORWESCO bands are custom fabricated to support the NORWESCO tanks and are galvanized or powder coated for added corrosion protection. Whether using the tank in a stationary position or for transport, bands are necessary to ensure that the tank retains its shape and integrity.

Horizontal Leg Tank Bands

Tank Size (Gallon)	A	B	No. of Bands	Part No.
35 ∞	18½"	18½"	2 optional	60520
55 ∞	22"	22"	2 optional	61745
65 ∞	22"	22"	2 optional	61745
125 ∞	30¾"	30½"	2 optional	61744
225 ∞	36¾"	36½"	2 optional	60478
325 ∞	36¾"	36½"	2 optional	60478
525	47¾"	47½"	2 optional	60057
725	47¾"	47½"	3 required	60057
1025	47¾"	47½"	4 required	60057
1325	64"	64"	3 required	63282
5025	90"	89½"	4 required	63284

∞ Within UPS dimensional limits

Drainable Leg Tank Bands

Tank Size (Gallon)	A	B	No. of Bands	Part No.
710	46¼"	45"	3 required	60584 short
1010 *	46¼"	45"	2 required	60584 short
1010 *	48"	45"	2 required	60585 long
1310	64"	64"	3 required	63282
1610	49"	66"	4 required	62434
2610 *	58"	87½"	2 required	63044 short
2610 *	62"	87½"	2 required	63045 long
3210 *	56"	89½"	2 required	62347 short
3210 *	60"	89½"	2 required	62348 long

* 2 short and 2 long bands are required for 1 tank

Elliptical Leg Tank Bands

Tank Size (Gallon)	A	B	No. of Bands	Part No.
1035	47¼"	77"	3 required	60325
1235	47¾"	64¾"	4 required	60477
1635	51"	68"	4 required	60586
2035	51¼"	81½"	4 required	62079
2635	65¼"	87½"	4 required	60353
3135	75¼"	85½"	4 required	62097
4035	70¼"	89½"	4 required	62832

Skid

Description	Part No.
Skid for 2610	63217
Skid for 3210 drainable leg tank	62906
Bolt Kit for 3210 (optional)	63024

Ladders

Description	Tank Size (Gallon)	Part No.
Ladder (optional)	2635 & 3135	60354
Ladder (optional)	2610 & 3210	63047
Ladder (optional)	4035	63033
Adaptor kit for ladder Δ	3135	62301

Δ This kit is required when using the ladder on the 3135 gallon tank



Mini Bulk Tanks

NORWESCO mini bulk tanks are available in two sizes and are most frequently used for chemical dispensing. The tanks can be mounted on forklift accessible pads for ease of movement. A 2" polypropylene fitting is installed directly across from the manway.

Gallon Capacity	Diameter	Height	Fill Opening	Fitting	Premium Weight Part No. White
120	38"	29"	5"	2"	40318
220	42"	42"	5"	2"	40320

Pickup Truck Tanks

Designed to fit full-size, American-made pickups, the 325 and 425 sizes have low profiles for better rear vision. They feature fill openings offset to the side of the tank for safety and easy access. A tough circular design adds strength. The 210 gallon tank fits both "mini" pickups and full-size models.

Gallon Capacity	Top Width or Diameter	Bottom Width or Diameter	Overall Height	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
210	60"/51"	48"/39"	28"	8"	2"	40300
325	62"	49"	32"	8"	2"	40160
425	65"	49"	37"	8"	2"	40102



PCO Tanks

A multi-purpose tank, the PCO is well suited for nursery, agricultural and lawn care applications. These tanks feature self-supporting legs and do not require any saddles or steel supports. Flat spots are molded into both ends to provide mounting areas for agitation equipment.



Gallon Capacity	Width	Height	Length	Fill Opening	Premium Weight Part No. White
30 ∞	19"	22"	25"	5"	41254
50 ∞	19"	20"	38"	8"	40664
100	30"	26"	38"	8"	40668
150	36"	26"	48"	8"	40669
200	36"	35"	48"	8"	41413
300	36"	37"	69"	16"	41381

∞ Within UPS dimensional limits

Elliptical Tanks

Designed for larger volume applicator needs, the NORWESCO elliptical tanks feature a low profile design and a low center of gravity for excellent visibility in the field and increased stability when towed. A deep sump permits complete drainage and the tanks feature an 8" or 16" fill-well. Please refer to information below for steel supports.



750 Gallon Elliptical

Gallon Capacity	Width	Height	Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
200	40"	28"	66"	8"	1¼" & 1¼"	41252
300	48"	32"	70"	16"	1¼" & 1¼"	40327
500	57"	38"	82"	16"	1¼" & 1¼"	40328
750	69"	44"	88"	16"	2"	40329
1000	78"	51"	90"	16"	2"	40330
1600 *	78"	49"	138"	16"	2"	47111
2550 **	88"	69"	142"	16"	3"	47677

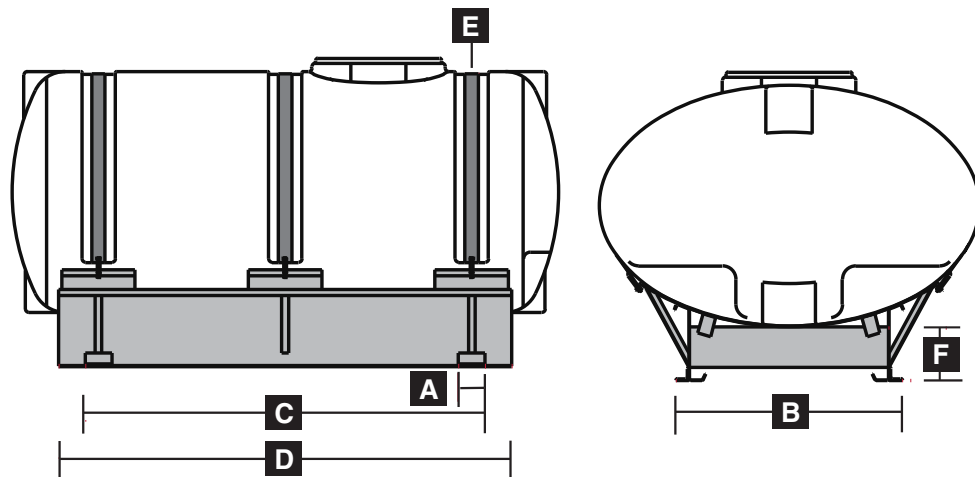
* Includes 1 stainless steel baffle ** The 2550 requires support bands

Elliptical Tank Skids (See dimensional drawings below.)

Tank Size (Gallon)	Tank Part No.	A	B	C	D	E	F	Part No.
200	41252	4"	24"	52"	57"	2" x 68"	8"	63015
300	40327	4"	34"	46¼"	54¼"	2" x 76"	8"	63016
500	40328	4"	34"	60"	68"	2" x 94"	8"	63018
750	40329	4"	38"	69½"	78"	2" x 112"	8"	60371
1000	40330	4"	46"	60"	72"	2" x 130"	8"	60372
1600	47111	10½"	40"	114½"	118¼"	3½" x 126"	6½"	67428
2550 *	47677	—	—	—	—	—	—	67456

* Band only, no skid. The 2550 requires 4 support bands, part #67456.

Replacement bands and hardware are available. Please contact NORWESCO Customer Service for details.



Applicator Tanks, Inductor Tanks and Spot Sprayers

Whether you're looking for a new or replacement tank, you'll find it in the NORWESCO line. All NORWESCO applicator tanks feature a lid which threads directly into the fill-well of the tank to prevent the sloshing or leaking of tank contents during transport or application. The inductor tanks are suitable for mixing chemicals when filling a tank and are available in three sizes. The spot sprayers feature threaded inserts on the bottom of the tank for mounting purposes, on one side for wand/gun placement and on the top for a 12 volt pump. Please refer to page 8 for steel supports.



12 Gallon Applicator



150 Gallon x 32" Applicator



200 Gallon x 32" Applicator



500 Gallon Applicator

Applicator Tanks

Gallon Capacity	Diameter	Height/Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
12 ∞	14" wide	12"/18"	5"	3/4"	60521
20 ∞	15"	31"	5"	3/4"	61737
30 ∞	23"	21"	5"	3/4"	41799
55 ∞	23"	34"	5"	3/4"	45193
85	23"	52"	5"	3/4"	45105
110	30"	41"	8"	1 1/4" & 1 1/4"	45053
150	30"	58"	8"	1 1/4" & 1 1/4"	40648
150	32"	46"	8"	1 1/4" & 1 1/4"	45117

∞ Within UPS dimensional limits

Gallon Capacity	Diameter	Height/Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
200	32"	62"	8"	1 1/4" & 1 1/4"	45059
200	38"	47"	8"	1 1/4" & 1 1/4"	45061
300	38"	68"	8"	1 1/4" & 1 1/4"	40135
400	42"	74"	8"	1 1/4" & 1 1/4"	40137
500	48"	75"	8"	1 1/4" & 1 1/4"	40274
150 Slim Line	28"	40"/50"	8"	1 1/4" & 1 1/4"	40777
200 Slim Line	24"	46"/61"	8"	1 1/4" & 1 1/4"	41305
200 Slim Line	31"	44"/48"	8"	1 1/4" & 1 1/4"	40780

Inductor Tanks

Gallon Capacity	Diameter	Height/Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
15 ∞	19"	23"	8"	2"	60214
35 ∞	23"	27"	8"	2"	45098
60	31"	31"	16"	2"	62205

∞ Within UPS dimensional limits



35 Gallon Inductor

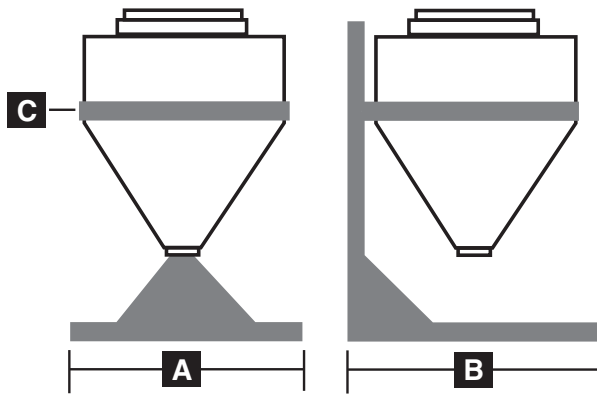
Spot Sprayers

Gallon Capacity	Width	Height/Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
14 ∞	14"	11"/31"	5"	—	45115
25 ∞	18"	16"/36"	5"	—	62080

∞ Within UPS dimensional limits



14 and 25 Gallon Spot Sprayer



Applicator Saddle Assemblies and Inductor Stands

Designed to provide necessary support for the applicator/inductor tank during use. NORWESCO saddles include polyester straps, buckles and bolts to secure tanks, and inductor stands are supplied with all necessary hardware.

Inductor Tank Stands (See dimensional drawings above.)

Tank Size (Gallon)	Tank Part No.	A	B	C	Part No.
15 ∞	60214	26"	15"	2" x 56"	60313
35 ∞	45098	25"	18"	1½" x 35" (2)	65517
60 ∞	62205	33"	24"	1½" x 46" (2)	62204

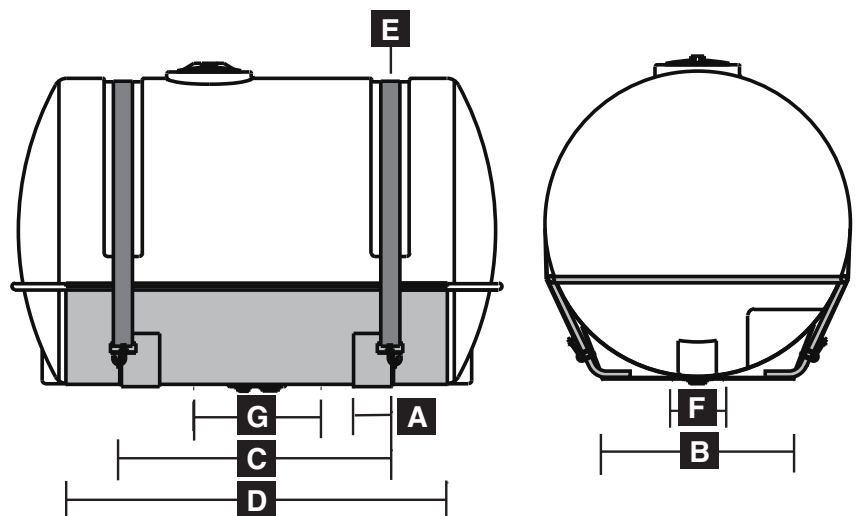
∞ Within UPS dimensional limits

Applicator Tank Saddle Assemblies (See dimensional drawings below.)

Tank Size (Gallon)	Tank Part No.	A	B	C	D	E	F	G	Part No.
30 ∞	41799	3"	19"	13½"	13½"	2" x 54"	8"	7¾"	60321
55 ∞	45193	6"	18⅞"	24"	24"	2" x 48"	—	12"	60303
110 ∞	45053	6"	23¾"	28¾"	34¾"	2" x 72"	—	10¾"	60315
150 - 32" ∞	45117	6"	23¾"	28¾"	34¾"	2" x 72"	—	10¾"	60315
200 - 32"	45059	6"	24⅞"	36"	60"	2" x 96"	8"	13¼"	63019
200 - 38"	45061	6"	24¾"	34"	42"	2" x 96"	—	13¼"	63020
300 - 38"	40135	6"	24¾"	34"	60"	3" x 96"	8"	12"	63021
400 - 42"	40137	6"	30⅞"	42½"	60"	3" x 96"	8"	12"	63022
500 - 48"	40274	6"	30⅞"	42½"	60"	3" x 132"	8"	12"	63023

∞ Within UPS dimensional limits

Replacement bands and hardware are available. Please contact NORWESCO Customer Service for details.



Cone Bottom Tanks

NORWESCO offers a full range of cone bottom tanks designed for a variety of applications. The conical bottoms enable quick and complete drainage. As with all NORWESCO tanks, the cone bottom tanks are molded of rugged, high density polyethylene and are both impact and chemical resistant. Please refer to page 10 for polyethylene or steel stands.

Gallon Capacity	Diameter	Height	Slope	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White	Heavy Weight Part No. Blue
175 w/stand*	42"	49"/10"†	30°	16"	2"	60113	—
300 w/stand*	48"	60"/9"†	30°	16"	2"	62343	—
310 w/stand*	42"	71"/10"†	30°	8"	2"	62441	—
500 w/stand*	48"	85"/9"†	30°	16"	2"	40289	—
750	72"	55"	20°	16"	2"	40811	—
750 w/stand*	72"	65"/10"†	20°	16"	2"	40809	—
1050	72"	74"	20°	16"	2"	40356	—
1050 w/stand*	72"	85"/11"†	20°	16"	2"	40359	—
1600	88"	83"	30°	16"	2"	40817	40819
1600 w/stand*	88"	94"/11"†	30°	16"	2"	40813	40815
2500	95"	104"	30°	16"	2"	40066	40129
2500 w/stand*	95"	114"/10"†	30°	16"	2"	40672	40674
3000	95"	121"	30°	16"	2"	40170	40172
3000 w/stand*	95"	131"/10"†	30°	16"	2"	40797	40799
3000 15° slope**	91"	119"	15°	16"	3"/2"	45141	—
5500	118"	146"	30°	16"	3"/2"	40549	40316
6000	102"	195"	15°	16"	3"/2"	40931	40933
7500	141"	149"	30°	16"	3"/2"	40551	40409

*Polyethylene stand **Stand not available for this tank †Distance from bottom of cone to ground



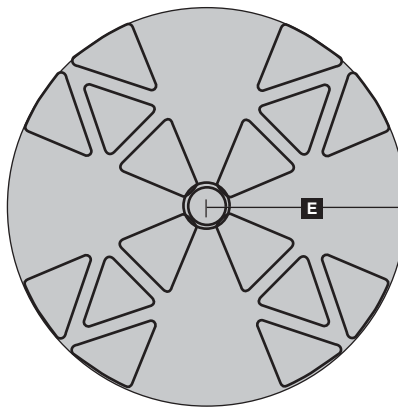
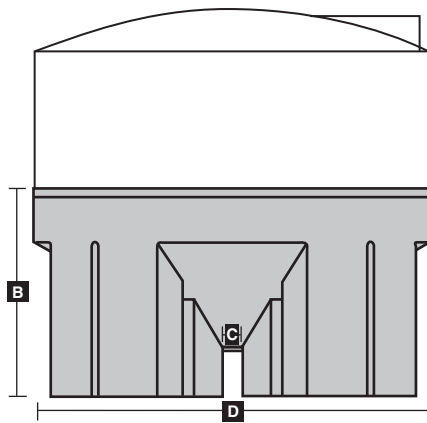
**500 Gallon
Cone Bottom
with Polyethylene
Stand**



**1600 Gallon Cone Bottom
with Polyethylene Stand**



**3000 Gallon Cone Bottom
with Heavy Duty Stand**



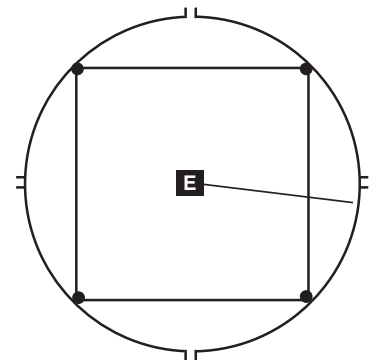
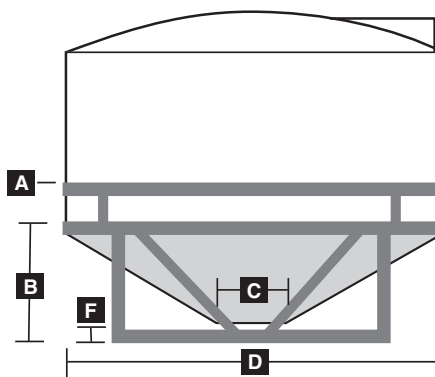
Polyethylene Cone Bottom Stands

Maintenance free, lightweight NORWESCO polyethylene stands offer unequalled corrosion resistance.

Tank Size (Gallon)	A	B	C	D	E
175	—	31½"	8"	42"	21"
300	—	32"	8"	48"	24⅝"
310	—	31½"	8"	42"	21"
500	—	32"	8"	48⅝"	24⅝"
750	—	34"	10"	72⅝"	36⅝"
1050	—	34"	10"	72⅝"	36⅝"
1600	—	46"	10"	88"	44"
2500/3000 (30°)	—	47"	10"	96⅝"	48⅝"

Heavy Duty Cone Bottom Stands

NORWESCO heavy duty cone bottom stands are manufactured from structural steel and offer a full dish for uniform support. An optional top band is available for the 2500/3000 steel stand when additional support is needed.



Tank Size (Gallon)	A	B	C	D	E	F	Part No.
2500/3000 (30°)	—	36"	11"	96"	48"	11"	60059
5500	—	45"	11"	119"	59½"	12½"	60358
6000	—	25"	13"	102"	51"	12⅝"	62473
7500	—	49"	11"	140"	70"	10¾"	61860
2500/3000 (30°)	Optional Top Band Assembly	—	—	—	—	—	60359

Specialty Tanks

Horizontal Box Tanks

The low profile design of this tank makes it ideal for use on trailers or in the back of a truck. The slosh reduction ribs provide excellent structural support. It can also be used as a stationary water storage tank.

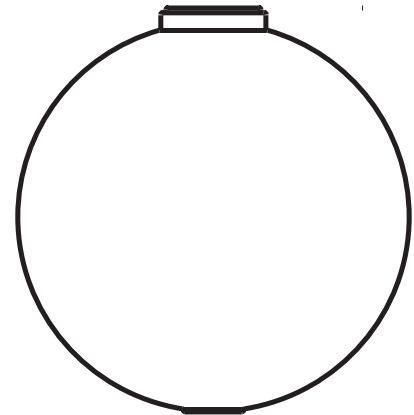


Gallon Capacity	Width	Height	Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
2400	90"	50"	150"	16"	2"	40912

Sphere

The 1000 gallon sphere is one of our more specialized tanks that is used on trailers/nurse trailers. The advantage of using this type of tank and trailer combination is that it has a shorter wheel-base which means less sloshing and the design of the tank allows for easy mixing of product.

Gallon Capacity	Diameter	Height	Fill Opening	Outlet/Drain Specification	Premium Weight Part No.
1000	78"	82"	16"	—	41277



Specialty Water Tanks

These tanks have been specifically designed with residential and commercial applications in mind. The dimensions of the 375 or 400 gallon allow it to fit through a conventional doorway. The design of the 400 gallon tank allows it to be freestanding/self-supporting and eliminates the need for a steel support frame. The 375 comes standard with a steel support frame. The 1250 and 1500 gallon low profile tanks may be used for storage or transport. They are an excellent choice when height limitations are a factor and are the perfect height for putting under your cottage or cabin.

Gallon Capacity	Width	Height	Length	Fill Opening	Outlet/Drain Specification	Premium Weight Part No. White
-----------------	-------	--------	--------	--------------	----------------------------	-------------------------------

Free Standing Water Tank

300	29"	49"	62"	16"	1¼"	41869
400	29"	65"	62"	16"	1¼"	41247



375 Gallon Tank with Frame



300 and 400 Gallon Freestanding Tank

Water Tank With Frame

375	30"	60"	62"	16"	1¼"	40480
-----	-----	-----	-----	-----	-----	-------

Low Profile Water Tank

1250	80"	35"	132"	16"	2"	40756
1500	81"	41"	130"	16"	2"	41392



1250 and 1500 Gallon Low Profile Tank



A



B



C



D



E

High Density Polyethylene Lids

Description	Item Code	Part No.
16" Lid and ring with 4" center lid/air vent		60038
16" Lid with 4" center lid/air vent	A	60011
16" Ring only		60012
16" Lid, ventless with ring		60367
16" Lid, ventless	B	60365
Gasket for 16" non-hinged lid		62941
4" Lid (air vent assembly for 16" lid)		60019
8" Lid, ring and air vent		60032
8" Lid with air vent	C	60002
8" Ring only		60003
Air vent for 8" lid only (snap on)		61727
5" Lid with ball check air vent (for tanks manufactured after 2/1/00)	D	62801
5" Lid with ball check air vent (for tanks manufactured prior to 2/1/00)	D	60322
5" Lid (for tanks manufactured after 2/1/00)	E	62476
5" Lid with 2" FPT		63264
Gasket for 5" lid, 60322, 62801 and 63264		60366
2" MPT vent cap with poly screen		63266
18" lanyard for 8" lid and 16" non-hinged lid (tethers lid to tank)		62531
Stainless steel screws for 8" and 16" rings		60081

Hinged Lid

This lid is manufactured from a co-polymer material for strength, durability and excellent chemical resistance. Our unique locking tab allows you to easily slip a padlock through it and secure your lid from theft or spills. The lid is interchangeable with a standard 16" lid and ring assembly if you choose to replace your existing lid.

- Easy open/close – opens a full 180 degrees
- Comes complete with a baffle vent assembly, allowing for adequate venting when bottom filling your tank.
- Unique locking tab
- All parts of lid may be ordered as repair parts

Description	Part No.
Complete lid assembly	62532

Hinged Lid Repair Parts

16" hinged lid with vent assembly, without ring	62826
Vent assembly	62827
Ring assembly	62828
Hinge assembly	62829
EPDM O-ring for lid	62830
Neoprene O-ring for ring	62831



Polyethylene Tank Repair Kits

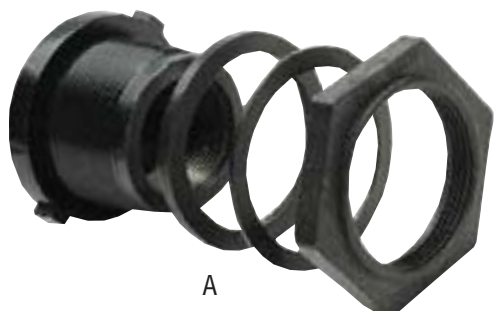
The tank repair kit (welding gun and rod) includes a specially formulated welding wire containing copolymers and adhesives. Wire may be used to effectively repair linear polyethylene. Easy to use and requires only 110 volt power. The poly patch kit is ideal for repairing pinholes, hairline cracks and holes up to 1/2" in diameter. For best results, surface to be repaired should be above 32° F. The kit consists of epoxy, a small brush to apply the epoxy, a small piece of sandpaper to "roughen" the area to be patched, a piece of mastic to temporarily fill the hole/crack and a piece of fiberglass.

	Part No.
Poly welding gun & rod	60221
Poly welding rod 30'	61879
Poly patch kit	67412

Polypropylene Bulkhead Fittings / EPDM Or Viton Gaskets

NORWESCO'S polypropylene fittings come standard with an EPDM gasket.

Viton gaskets are available as an option when EPDM may not be suitable for your application.



A



B

C

Description	Hole Size Required in Tank for Installation	Part No.	Item Code
1/2" Heavy duty double threaded polypropylene fitting	1 3/8"	62834	A
3/4" Double threaded polypropylene fitting	1 3/8"	60401	A
EPDM gasket for 1/2" and 3/4" (60401)		60402	
Viton gasket for 1/2" and 3/4" (60401)		60360	
3/4" Heavy duty double threaded polypropylene fitting	1 3/8"	62798	A
EPDM gasket 3/4" (62798)		62799	
Viton gasket for 3/4" (62798)		62800	
1" Double threaded polypropylene fitting	2 1/4"	60427	A
1 1/4" Double threaded polypropylene fitting	2 1/4"	60403	A
1 1/4" Anti-vortex polypropylene fitting		63065	
EPDM gasket for 1" and 1 1/4"		60404	
Viton gasket for 1" and 1 1/4"		60361	
Anti-vortex adapter for 1 1/4"		62398	
1 1/2" Double threaded polypropylene fitting	3"	60124	A
Siphon tube, 1 1/2" x 12" long		63279	
2" Double threaded polypropylene fitting	3"	60405	A
2" Double threaded 316 stainless steel fitting, less gasket	3"	61767	
EPDM gasket for 1 1/2" and 2" (60405 and 61767)		60406	
Type B Viton gasket for 1 1/2" and 2" (60405 and 61767)		60523	
2" Heavy duty double threaded polypropylene fitting with siphon tube	3 1/4"	60337	B
EPDM gasket for 2" (60337)		60336	
Type B Viton gasket for 2" (60337)		60008	
Siphon tube, 2" short		60335	
Siphon tube, 2" x 12" long		63262	
2" MPT vent cap, anti-vortex, with poly screen		63266	
2" MPT vent cap, anti-vortex, without screen		63316	
Anti-vortex adapter for 2" Bulkhead fitting		62399	
2" Polypropylene dust plug		60021	
3" Double threaded polypropylene fitting (hex nut as shown in photo C)	4 5/8" *	62299	
3" Double threaded polypropylene fitting with 2" reducer and siphon tube	4 5/8" *	60339	C
EPDM gasket for 3"		60331	
Type B Viton gasket for 3"		60351	
2" Polypropylene reducer for 3"		60330	
Siphon tube, 3" short		60327	
Siphon tube, 3" x 12" long		63263	
4" Double threaded polypropylene fitting (hex nut as shown in photo C)	5 3/4"	62171	
EPDM gasket for 4"		62785	
Viton gasket for 4"		62786	
Siphon tube for 4"		62714	

*When installing fitting, use 4 1/2" hole saw if tank is cold.

Bolted Fittings

Polypropylene Bolted Fittings / EPDM or Viton Gaskets (Require two gaskets.)

Bolted polypropylene fittings are equipped with 316 stainless steel bolts and come standard with EPDM gaskets.

Viton gaskets are available as an option for the fittings.

Description	Part No.	Item Code
¾" Polypropylene bolted fitting with ss bolts and EPDM gaskets	60502	A
1" Polypropylene bolted fitting with ss bolts and EPDM gaskets	60505	A
EPDM gasket for ¾" and 1"	60498	
Type B Viton gasket for ¾" and 1"	60355	
1½" Polypropylene bolted fitting with ss bolts and EPDM gaskets	60513	A
2" Polypropylene bolted fitting with ss bolts and EPDM gaskets	60516	A
EPDM gasket for 1½" and 2"	60497	
Type B Viton gasket for 1½" and 2"	60356	
3" Polypropylene bolted fitting with ss bolts and EPDM gaskets	62471	
EPDM gasket for 3"	62048	
Type B Viton gasket for 3"	60602	



A

Stainless Steel Double Threaded Bolted Fittings

Bolts are threaded into the back plate of the fitting so there are no welds or bolt holes that can be potential points of leakage. These fittings come standard without a gasket (with the exception of the 4") and require a single gasket that is installed on the inside of the tank. Available gaskets are cross-linked polyethylene, EPDM or Viton (4" fitting comes standard with a cross-linked polyethylene gasket).

Description	Part No.	Item Code
½" 316 Stainless steel double threaded bolted fitting less gasket	63216	B
¾" 316 Stainless steel double threaded bolted fitting less gasket	63035	B
1" 316 Stainless steel double threaded bolted fitting less gasket	62948	B
EPDM gasket for ½", ¾" & 1" (1 required)	63205	
Type B Viton gasket for ½", ¾" & 1" (1 required)	63224	
Cross-linked polyethylene gasket for ½", ¾" & 1" (1 required)	62950	
1¼" 316 Stainless steel double threaded bolted fitting less gasket	63036	B
Cross-linked polyethylene gasket for 1¼" (1 required)	63041	
1½" 316 Stainless steel double threaded bolted fitting less gasket	63037	B
Cross-linked polyethylene gasket for 1½" (1 required)	63042	
2" 316 Stainless steel double threaded bolted fitting less gasket	63038	B
EPDM gasket for 1¼", 1½" and 2" (1 required)	63206	
Type B Viton gasket for 1¼", 1½" and 2" (1 required)	63225	
Cross-linked polyethylene gasket for 2" (1 required)	62848	
3" 316 Stainless steel double threaded bolted fitting less gasket	63039	C
EPDM gasket for 3" (1 required)	63223	
Type B Viton gasket for 3" (1 required)	63226	
Cross-linked polyethylene gasket for 3" (1 required)	63043	
4" 316 Stainless steel 8-bolt double threaded bolted fitting with gasket	63069	
Cross-linked polyethylene gasket for 4" (1 required)	63070	



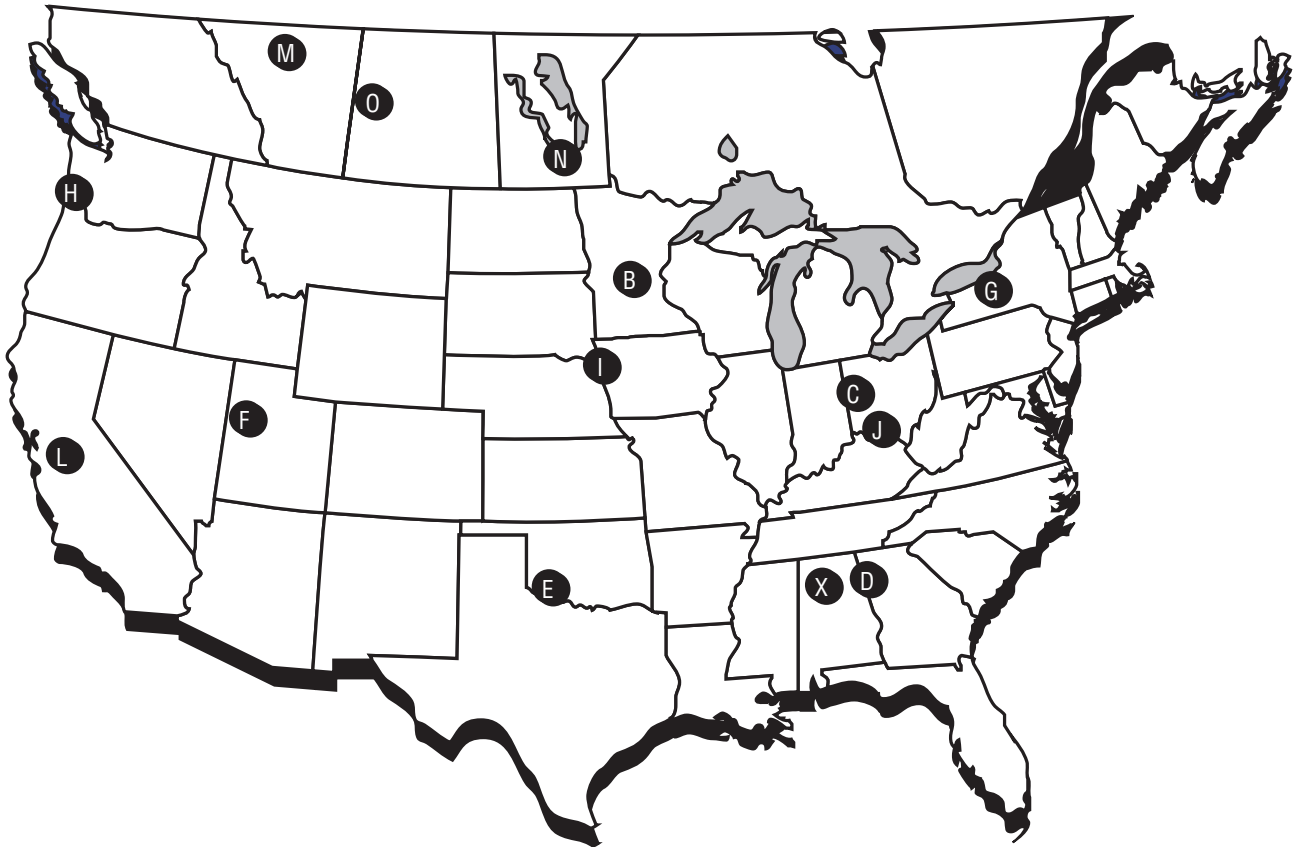
B



C

Stainless Steel Single Threaded Bolted Fittings

Description	Part No.
2" 316 Stainless steel single threaded bolted fitting less gasket	62847
EPDM gasket for 1¼", 1½" and 2" (1 required)	63206
Type B Viton gasket for 1¼", 1½" and 2" (1 required)	63225
Cross-linked polyethylene gasket for 2" (1 required)	62848
3" 316 Stainless steel single threaded bolted fitting less gasket	63233
EPDM gasket for 3" (1 required)	63223
Type B Viton gasket for 3" (1 required)	63226
Cross-linked polyethylene gasket for 3" (1 required)	63043



Manufacturing and Distribution

B. St. Bonifacius, Minnesota	G. Owego, New York	M. Edmonton, Alberta-Canada
C. Lancaster, Ohio	H. Washougal, Washington	N. Winnipeg, Manitoba-Canada
D. Griffin, Georgia	I. Sheldon, Iowa	X. Albertville, Alabama
E. Shawnee, Oklahoma	L. Hanford, California	O. Saskatoon, Saskatchewan-Canada
F. Tooele, Utah		

Tank dimensions and capacities may vary slightly and are subject to change without notice.

Warranty

NORWESCO offers a three year warranty from date of manufacture on all premium weight tanks and a five year warranty on all heavy weight tanks. Should a defect appear within the warranty period NORWESCO will supply a new, equivalent tank in replacement thereof. NORWESCO'S liability is limited to the value of the tank itself and specifically excludes the cost of installation and/or removal or consequential damages. Please contact your chemical supplier or NORWESCO Customer Service for chemical resistance information.



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MATERIALS LIST

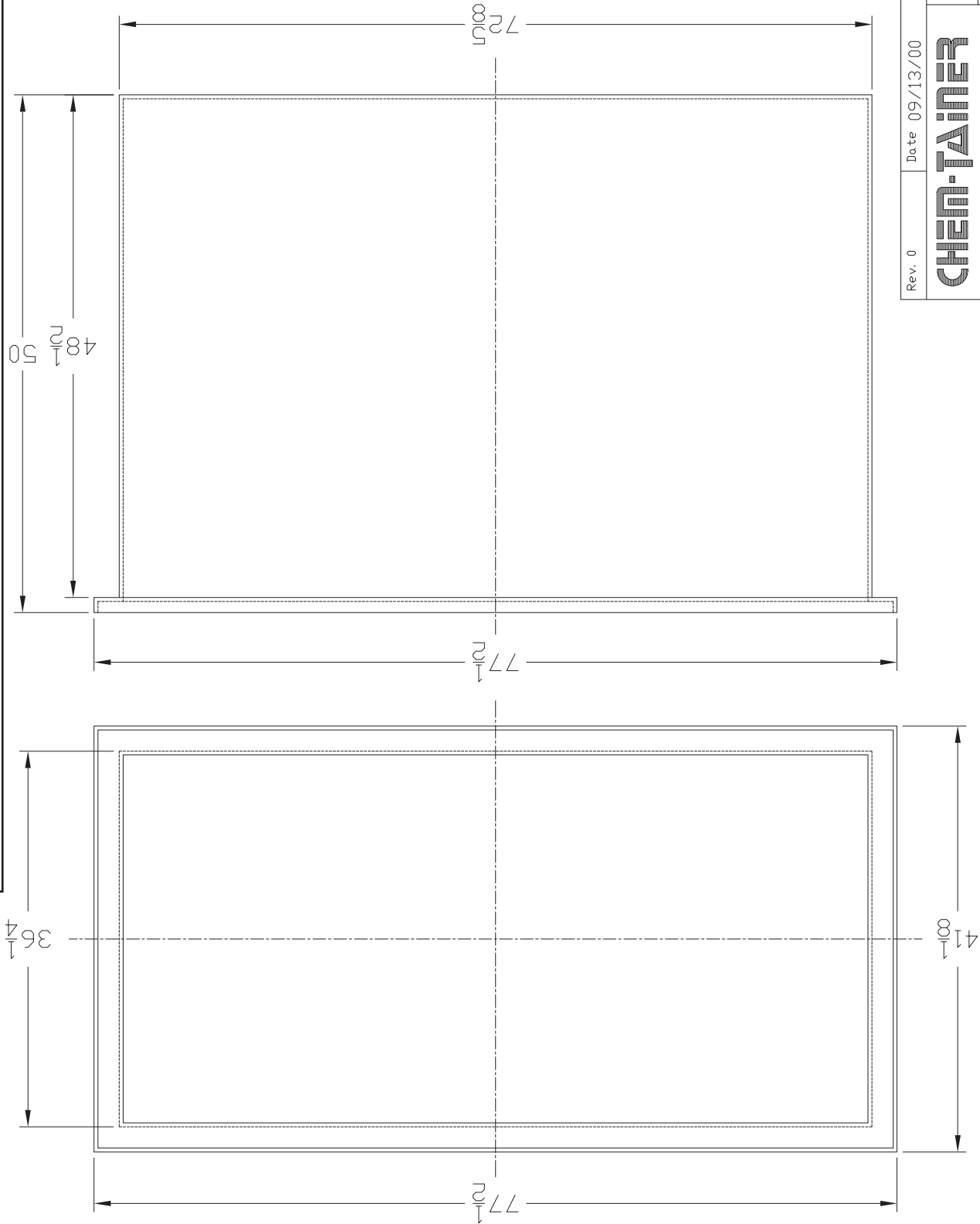
TOP VIEW

-

FAC
TRAN
CON-CO
ST

CT-4

TNK-201 - Tank, Open Top, Rectangular, 192 gal, 540 US Gal 72x36x48



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ALL DIMENSIONS SHOWN ARE OUTSIDE PART DIMENSIONS IN INCHES, AND VARY BY THE STANDARD ROTATIONAL MOLDING TOLERANCE OF +2/-3%.

Rev. 0	Date 09/13/00	File Name 367248-5
CHEM-TAINER		
Industries Inc.		Mold Location CA
361 Neptune Ave. W.Babylon, NY 11704	Drawn By: IIA	Cust. Rep.
(631) 661-8300	Fax: (631) 661-8209	
TITLE 540 GAL. RECTANGULAR TANK		
Part # R367248AB/CD	Dwg. # C- E31365 48-15	

ELMRIDGE® Liqui-Jet® Mixing Eductors

ME Series

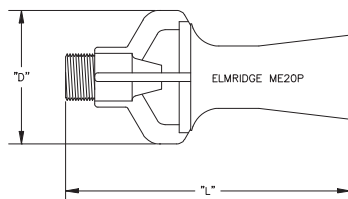
KEEPING SOLIDS IN SUSPENSION / DISPERSING CHEMICALS / MAINTAINING TANK CONCENTRATIONS / ELIMINATING THERMAL GRADIENTS

ELMRIDGE 'ME Series' Liqui-Jet Mixing Eductors vigorously and efficiently circulate the liquid contents of tanks without powered impellers or other insertion-type rotating mechanical devices. ELMRIDGE 'ME Series' Liqui-Jet Mixing Eductors operate on the same principle as our standard line of liquid-powered Jet-Apparatus. Liquid is pumped through the Eductor nozzle, emerging at a relatively high velocity, creating a localized zone of lower pressure. Tank contents are drawn to this lower pressure zone, where the momentum of the motive liquid is transferred to the tank liquid, causing the tank liquid to be 'pumped' and circulated. For every gallon of liquid pumped through the Eductor nozzle, up to five gallons of liquid is circulated. Note that Eductors can actually be 'aimed' at specific areas in the vessel. Operating characteristics (Water Motive / Water Suction), for standard models are shown below, and special units are also available to meet your specifications. Standard materials of construction are Glass Reinforced Polypropylene, PVDF, PVC, CPVC, Teflon®, Cast Iron, 316 Stainless Steel, Alloy 20, and Hastelloy C®. Other materials are available upon request. Threaded, flanged, or socket weld connections (except Cast Iron).



Table 1

Nozzle and Circulated Flow (usgpm) for ME Series Liqui-Jet Tank Mixing Eductors using 70 deg. F Water



Dimensions

Model Number	Pressure Connection	D (inches)	L (inches)
ME05P	1/4" Male*	1-1/2"	3-1/8"
ME10P	3/8" Male*	2-1/8"	4-1/2"
ME20P	3/4" Male*	3"	6-3/8"
ME30P	1" Male*	3-13/16"	8-1/16"
ME40P	1-1/2" Male*	4-5/8"	9-7/8"
ME10M	3/8" Male*	1-3/4"	4-1/2"
ME20M	3/4" Male*	2-3/8"	6-3/4"
ME30M	1" Male*	2-7/8"	7-5/8"
ME40M	1-1/2" Male*	4-5/8"	9-7/8"
ME40	1-1/2" Female*	3-3/4"	9-1/2"
ME50	2" **	5-5/8"	12-1/4"
ME60	3" **	8-1/2"	17-5/8"
ME70	4" **	12-1/2"	26-1/4"
ME80	6" ***	17-1/4"	36-1/2"
ME90	8" ***	22"	48-5/8"

* NPT or BSPT

** NPT or BSPT Female or 150# ANSI FF Flange

*** 150# ANSI FF Flange only

Model Number	Flow Type	Operating Water Pressure (psi)								
		10	15	20	25	30	35	40	50	60
ME05P	Nozzle Flow	3.2	3.9	4.5	5.0	5.5	5.9	6.3	7.1	7.8
	Circ. Flow	16	20	23	25	28	30	32	36	39
ME10P	Nozzle Flow	7.5	9.2	10.6	11.9	13.0	14.0	15	17	18
	Circ. Flow	38	46	53	59	65	70	75	84	92
ME20P	Nozzle Flow	13.5	17	19	21	23	25	27	30	33
	Circ. Flow	68	83	95	107	117	126	135	151	165
ME30P	Nozzle Flow	20	24	28	32	35	37	40	45	49
	Circ. Flow	100	122	141	158	173	187	200	224	245
ME40P	Nozzle Flow	33	40	47	52	57	62	66	74	81
	Circ. Flow	165	202	233	261	286	309	330	369	404
ME10	Nozzle Flow	8.2	10	12	13	14	15	16	18	20
	Circ. Flow	33	40	46	52	57	61	66	73	80
ME20	Nozzle Flow	12	15	17	19	21	22	24	27	29
	Circ. Flow	48	59	68	76	83	90	96	107	118
ME30	Nozzle Flow	21	26	30	33	36	39	42	47	51
	Circ. Flow	84	103	119	133	145	157	168	188	206
ME40	Nozzle Flow	35	43	49	55	61	65	70	78	86
	Circ. Flow	140	171	198	221	242	262	280	313	343
ME50	Nozzle Flow	55	67	78	87	95	103	110	123	135
	Circ. Flow	275	337	389	435	476	514	550	615	674
ME60	Nozzle Flow	126	154	178	199	218	236	252	282	309
	Circ. Flow	630	772	891	996	1091	1179	1260	1409	1543
ME70	Nozzle Flow	285	349	403	451	494	533	570	637	698
	Circ. Flow	1425	1745	2015	2253	2468	2666	2850	3186	3491
ME80	Nozzle Flow	590	723	834	933	1022	1104	1180	1319	1445
	Circ. Flow	2950	3613	4172	4664	5110	5519	5900	6596	7226
ME90	Nozzle Flow	1062	1301	1502	1679	1839	1987	2124	2375	2601
	Circ. Flow	5310	6503	7509	8396	9197	9934	10620	11874	13007

TANK MIXING

APPLICATION EXAMPLES

EXAMPLE 1:

The volume of a rectangular process tank is 5,000 US gallons (approximately 10'W x 15'L x 4.5'H). In order that the contents of the tank remain in homogenous solution, it is necessary that the tank volume be completely turned over (ie. completely recirculated), in a period of approx. 8 minutes. It has further been determined that eductor spacing not exceed 3' in order to utilize the eductor outlet plume to further agitate the bottom corners of the tank. There is an existing single header of sufficient capacity centered longitudinally along the bottom of the tank, and a pump that will supply sufficient volume at 30 psig.

1. Four eductors spaced on 3' centers on each side of the header pipe will meet the necessary spacing requirements.
2. The number of eductors required is:

$$4 \times 2 \text{ sides} = 8 \text{ eductors}$$

3. Total required recirculation flowrate is:

$$5000 / 8 \text{ min.} = 625 \text{ usgpm}$$

4. Required recirculation flowrate per eductor is:

$$625 / 8 \text{ eductors} = 78.1 \text{ usgpm}$$

5. An ME20 eductor has a circulated flowrate of 83 usgpm at 30 psig., therefore a quantity of (8) ME20 eductors could be used.

6. The nozzle flow of an ME20 eductor at 30 psig is 21 usgpm, therefore, the pump must be able to supply:

$$8 \times 21 = 168 \text{ usgpm at 30 psig}$$

EXAMPLE 2:

A steam-jacketed hot oil (S.G. = 1.21), preheat tank is 20' high and 10' in diameter (approx. 11750 usgal). It is desired that a single eductor using a portion of the total oil inflow turn over the contents of the tank in approx. 12 minutes in order to reduce temperature gradients within the tank. Pump pressure must also be approximated; assume inflow rate is sufficient.

1. The static discharge pressure that the pump must overcome is:

$$\begin{aligned} 20 \times 1.21 &= 24.2 \text{ feet of water} \\ &= 10.5 \text{ psig} \end{aligned}$$

2. Total required recirculation flowrate is:

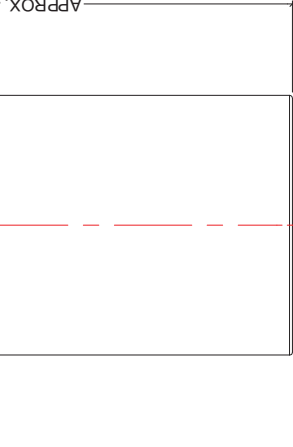
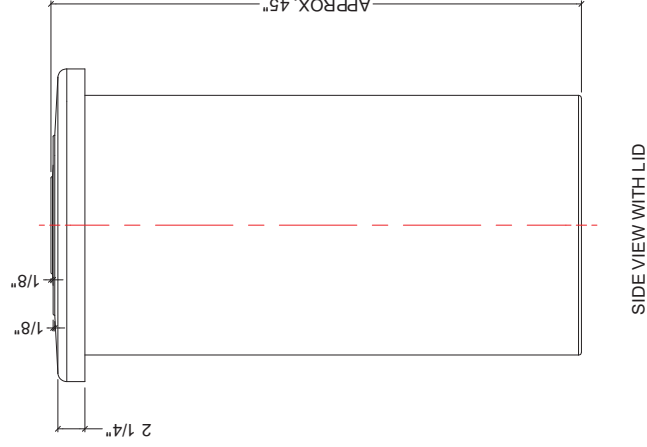
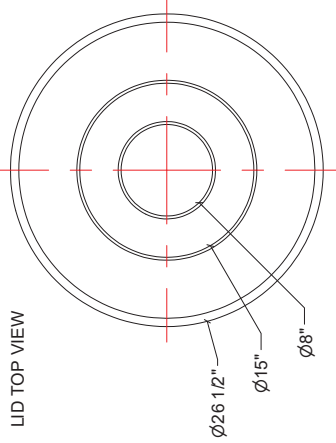
$$11750 / 12 = 979 \text{ usgpm}$$

4. An ME60 eductor has a circulated flowrate of 1091 usgpm at 30 psig, however, the pump must be sized to supply the ME60 nozzle flowrate of $218 \times \text{SQRT}(1/1.21) = 198 \text{ usgpm at}$:

$$30 + 10.5 = 40.5 \text{ psig}$$

NOTES:

1. TANK IS MANUFACTURED TO ASTM-D-1998 STANDARD.
2. ALL DIMENSIONS ARE APPROXIMATE.

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A19 Series

Remote Bulb Control

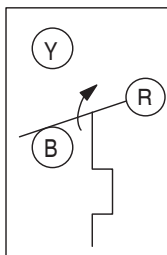
Description

The A19 Series are single-stage temperature controls that incorporate environmentally friendly liquid-filled sensing elements.

Features

- wide temperature ranges available
- constant differential throughout the entire range
- compact enclosure
- fixed or adjustable differential available
- variety of sensing element styles
- unaffected by cross-ambient conditions

A19 Series



Action on Increase of Temperature

a19.eps



A19ABC-24

Applications

The A19 is suitable for temperature control in heating, ventilating, air conditioning, and refrigeration.

A19 Series
Terminal Arrangement for SPDT

Selection Charts

A19 Series Remote Bulb Control¹

Code Number	Switch Action	Range °F (°C)	Diff °F (°C)	Bulb and Capillary	Bulb Well No. (order separately)	Range Adjuster	Max. Bulb Temp. °F (°C)
Adjustable Differential (Wide Range)							
A19ABA-40C ²	SPST Open Low	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 6 ft. Cap.	WEL14A-602R	Screwdriver Slot	140 (60)
A19ABC-4C	SPDT	50 to 130 (10 to 55)	3 1/2 to 14 (1.9 to 8)	3/8 in. x 5 in., 8 ft. Cap.	WEL14A-603R	Knob	170 (77)
A19ABC-24C ³	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 8 ft. Cap.	WEL14A-602R	Convertible	140 (60)
A19ABC-36C	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 20 ft. Cap.	WEL14A-602R	Convertible	140 (60)
A19ABC-37C	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 10 ft. Cap.	WEL14A-602R	Screwdriver slot	140 (60)
A19ABC-74C	SPDT	-30 to 100 (-34 to 38)	3 to 12 (1.7 to 6.7)	3/8 in. x 4 in., 6 ft. Cap.	WEL14A-602R	Screwdriver slot	140 (60)
Fixed Differential							
A19AAF-12C	SPDT	25 to 225 (-4 to 107)	3 1/2 (1.9)	3/8 in. x 3 in., 10 ft. Cap.	WEL14A-602R	Screwdriver slot	275 (135)
Fixed Differential (Case Compensated)							
A19AAC-4C	SPDT	0 to 80 (-18 to 27)	5 (2.8)	3/8 in. x 4 in., 6 ft. Cap.	WEL14A-602R	Screwdriver slot	140 (60)
A19AAD-12C	SPST Open Low	-30 to 50 (-34 to 10)	2 1/2 (1.4)	3/8 in. x 4 in., 7 ft. Cap.	WEL14A-602R	Screwdriver slot	140 (60)
Fixed Differential (Close)							
A19AAD-5C ⁴	SPST Open Low	30 to 50 (-1 to 10) (Bulk Milk Cooler)	2 1/2 (1.4)	3/8 in. x 2 5/8 in., 6 ft. Cap.	WEL16A-601R	Screwdriver slot	190 (88)
A19AAF-20C	SPDT	-30 to 100 (-34 to 38)	2 1/2 (1.4)	3/8 in. x 4 in., 6 ft. Cap.	WEL14A-602R	Screwdriver slot	140 (60)
A19AAF-21C	SPDT	40 to 90 (4 to 32)	1 1/2 (0.8)	3/8 in. x 5 3/4 in., 6 ft. Cap.	WEL14A-603R	Screwdriver slot	140 (60)
Manual Reset							
A19ACA-14C	SPST Open Low	-30 to 100 (-34 to 38)	Manual Reset	3/8 in. x 4 in., 6 ft. Cap.	WEL14A-602R	Screwdriver slot	140 (60)
A19ACA-15C	SPST Open Low	-30 to 100 (-34 to 38)	Manual Reset	3/8 in. x 4 in., 10 ft. Cap.	WEL14A-602R	Screwdriver slot	140 (60)
A19ADB-1C	SPST Open High	100 to 240 (38 to 116)	Manual Reset	3/8 in. x 3 1/2 in., 6 ft. Cap.	WEL14A-602R	Knob	290 (143)
A19ADN-1C	SPST Open High	100 to 240 (38 to 116)	Manual Reset	3/8 in. x 4 in., 6 ft. Cap.	WEL14A-602R	Screwdriver slot	290 (143)

1. Specify the control model code number, packing nut code number (if required), and bulb well code number (if required).

2. Replaces White-Rodgers 1609-101

3. Replaces White-Rodgers 1609-12, -13; Ranco 010-1408, -1409, -1410, -1490, 060-110; Honeywell L6018C-1006, L6021A-1005, T675A-1011, -1508, -1516, -1821, T4301A-1008, T6031A-1011, T6031A-1029

4. Case-Compensated

Operation and Maintenance Manuel – Construction Water Treatment Plant, Version 1

Operation & Maintenance Manual Construction Water Treatment Plant

Prepared by:
Agnico Eagle Mines Limited – Meadowbank/Amaruq Division

EXECUTIVE SUMMARY

Agnico Eagle has prepared the following document which summarizes the operational and maintenance procedures to be followed at the Construction Water Treatment Plant (CWTP).

This report documents the stand alone Operation & Maintenance Manual – Construction Water Treatment Plant, includes the following requirements:

- The manual was prepared in accordance with the “Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories, 1996”, and adapted for the use of a mechanical contact water treatment facility;
- The manual includes contingency measures in the event of a plant malfunction; and
- The manual includes sludge management procedures.

IMPLEMENTATION SCHEDULE

This Plan will be implemented upon Board approval and subject to any modifications proposed by the NWB as a result of the review and approval process.

DISTRIBUTION LIST

Agnico Eagle Internal:

- Process Plant Superintendent
- Process Plant General Foreman
- Energy&Infrastructures Services Superintendent
- Energy&Infrastructures Services General Foreman
- Environmental Superintendent
- Senior Environmental Coordinator
- Environmental Compliance Counselor
- Water Treatment Plant Operator

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
1	18/06/2018			Operation and Maintenance Manual

Prepared By: _____
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Project Manager, Environment

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Water treatment Specialist

Israel Gagnon
Mechanical Eng.

Approved by: _____
Julie Bélanger
Project Superintendent

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1 INTRODUCTION

1.1 PURPOSE

This Construction Water Treatment Plant (CWTP) Operation and Maintenance Manual (OMM) for the Whale Tail Gold Project (the Project) has been prepared based on the “*Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories, 1996, prepared by the Department of Municipal and Community Affairs, NWT*”. The OMM has been adapted for the use of a mechanical contact water treatment facility.

This manual is a component of the Whale Tail Environmental Management System. The objectives of this plan are summarized as follows:

1. To define the location, design and operating procedures to be used in the treatment of contact water generated at the Project; and
2. To provide monitoring requirements for the CWTP.

The CWTP purpose is to treat water during the dike construction of the Whale Tail Lake in summer 2018.

1.2 BRIEF DESCRIPTION OF THE PROJECT

Agnico Eagle Mines Limited – Meadowbank Division (Agnico Eagle) is developing Whale Tail Pit and Haul Road Project, a satellite deposit located on the Amaruq property, to extend mine operations and milling at Meadowbank Mine. The proposed open pit mine, mined by truck-and-shovel operation and will produce an ore grading at approximately 3.68 g/t from 2019 to 2025.

The Amaruq Mineral Deposit is considered to be an extension of the currently operating Meadowbank mine and most positions will be filled by Meadowbank employees. A conventional open pit mining operation is forecasted on the Whale Tail deposit. Access to the site is via a 64-kilometre road from Meadowbank mine. On-site facilities will include a power plant, maintenance facilities, tank farm for fuel storage, Construction water treatment plant (CWTP), sewage treatment plant, drinking water treatment plant, as well as accommodation and kitchen facilities for approximately 400 people.

In order to start the open pit development, a dike is required to be built in the Whale Tail Lake and water pumped from the north section of the lake to the south section of the lake.

During dike construction, lake sediment will likely be re-suspended. In order to contain the re-suspended sediments within the work area, before initiating construction, two rows of turbidity barriers will be installed on each side of the dewatering dike. Turbidity barriers are floating devices used in lakes or rivers. They are made of geotextile preventing sediment migration in water.

According to the Water Quality Monitoring and Management Plan for Dike Construction Dewatering, (Version 1 January 2017 Prepared by Agnico-Eagle Mines Limited – Meadowbank Division), during dike construction on Whale Tail Lake, contact water originating from affected areas in the lake will be pumped and treated by the Construction water treatment plant (CWTP) prior to discharge to the receiving environment. Figures 1 and 2 illustrate the location and general arrangement of the CWTP.

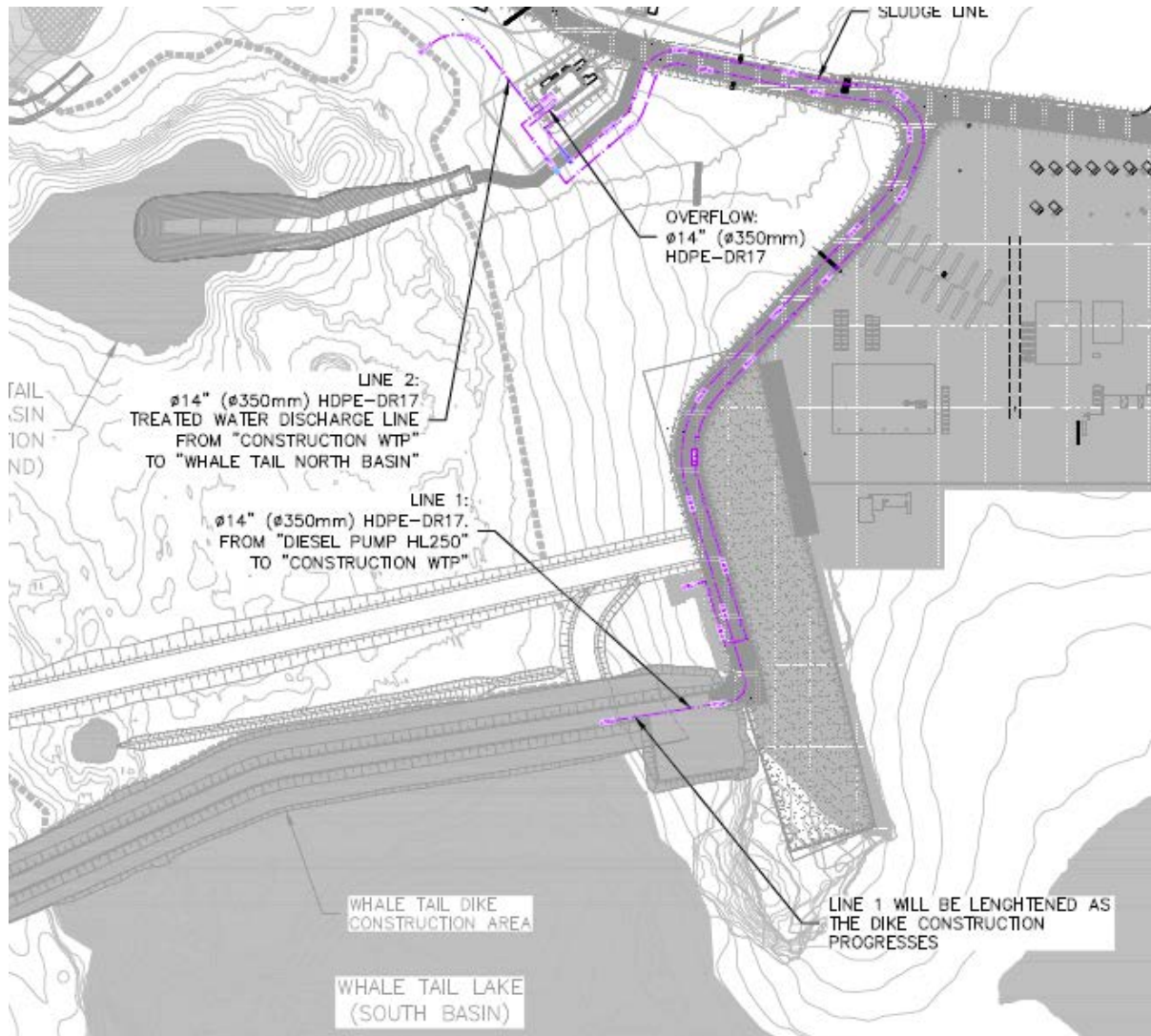


Figure 1 – Location of CWTP

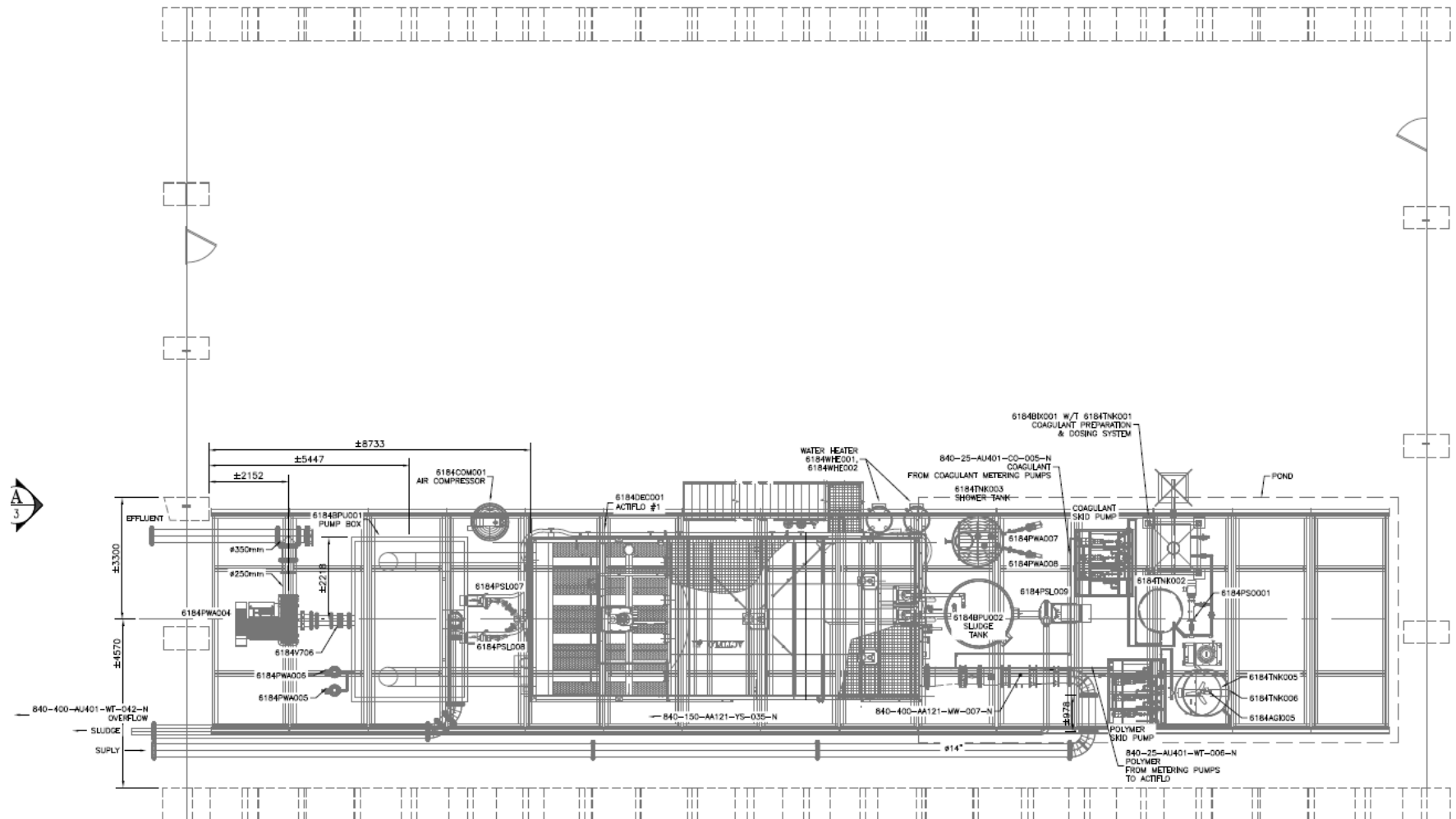


Figure 2 – General Arrangement of CWTP

1.3 CONTACT INFORMATION

The individuals responsible for the operation of the construction water treatment plant for the Project are the following:

Mill Superintendent	819-759-3555
Site Services Superintendent	819-759-3555
Site Services General Foreman	819-759-3555

2 DESCRIPTION

2.1 CONSTRUCTION WATER TREATMENT PLANT (CWTP)

2.1.1 Process summary

The purpose of the CWTP (ACP-700R) is to remove Total Suspended Solids (TSS) from the influent water pumped from Whale Tail Lake, close to the dike construction. The equipment has an operational range of 6,250 to 28,000 m³/d. It is expected that the CWTP will be in use only during the dike construction, approximately two (2) months in 2018 (July and August).

The equipment chosen for the CWTP was the current Actiflo[®] used in the past at Meadowbank mine. The plant was disassembled and would be reassembled at Amaruq site. The Actiflo[®] ACP 700 R as an operational range in the same order of magnitude than what is required for this project (max capacity of approximately 800 m³/h).

The main treatment component consists of one Actiflo[®] clarifier with two (2) recirculation lines and two (2) hydrocyclones. The Actiflo[®] can be operated with one (1) or two (2) lines, depending on the influent flow rate and TSS content. The hydrocyclone overflow is sent into the rock fill structure located in the energy dispenser at a minimum 31 m of the Whale Tail Lake shore. The TSS is passively removed from the water by percolating onto the rock fill structure located in the energy dispenser and water will flow by gravity back into Whale Tail Lake. The Actiflo[®] overflow is designed to meet the Type A License final effluent discharge criteria for TSS concentrations. The final effluent will be monitored on a continuous basis for pH and turbidity. Flow rate is measured continuously in the feed pipe of the Actiflo[®].

The CWTP general flow diagram is illustrated in Figure 3. The following sections describe the CWTP components. Note that the flowsheet represents the water treatment plant that had been installed in the past at Vault open pit, close to Meadowbank mine. This plant will be transported to Amaruq project and will be built according to the plan from Meadowbank.

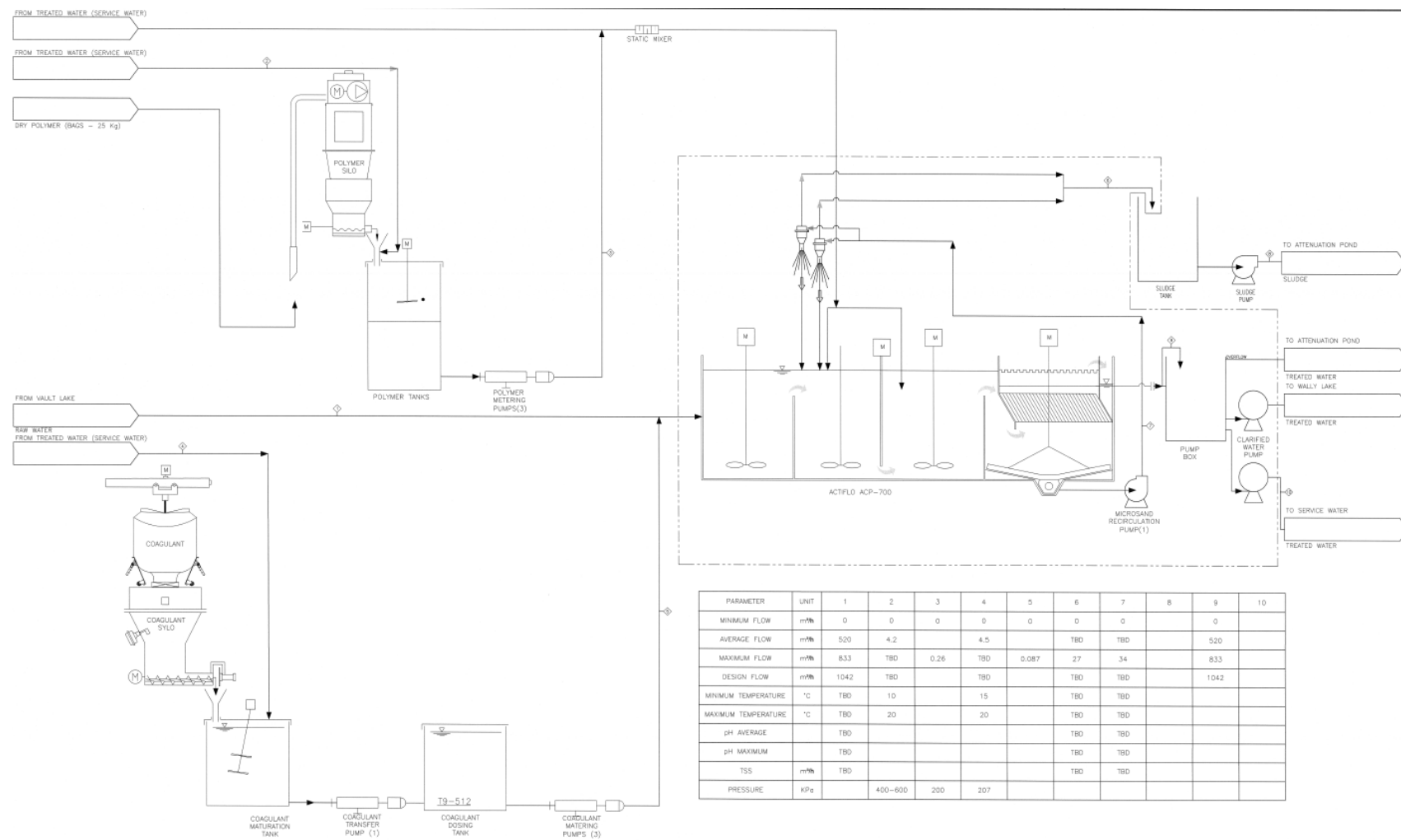


Figure 3 – Flowsheet of CWTP (adapted from Meadowbank water treatment plant)

2.1.2 Actiflo®

The Actiflo® clarifier uses sand ballasted settling, a high rate coagulation-flocculation-sedimentation process. In the coagulation basin, TSS are destabilized under the action of the coagulant and start to form small aggregates (also called flocs). The coagulant is a trivalent soluble metal compound, usually iron or aluminum, which will cause coagulation when it reaches a certain concentration. Once the coagulant has performed the destabilizing effect, it will precipitate as a metal hydroxide and will participate in the formation of the aggregates. Water then flows into a second tank called the injection tank. There, micro-sand and polymer are added. The polymer acts as a flocculant aid, binding the destabilized solids together with the micro-sand particles by forming polymer bridges. The micro-sand provides a large contact area for floc attachment and acts as a ballast, thereby accelerating the settling of the flocs. From the injection tank, water flows into the maturation tank where flocs formed in the previous stage agglomerate and grow into high density flocs known as micro-sand ballasted flocs. Water then overflows to the settling section of the tank, and with the help of the lamella system, a solid-liquid separation is achieved resulting in clarified water exiting from the system via a collection trough or weirs. The clarified water is monitored for pH and turbidity prior to final discharge. The flow rate signal is also connected to a flow totalizer.

The flocs settle in a portion of the system where they are collected by a rake mechanism. A proportion of the unit's design raw water flow is continuously withdrawn from the clarifier and pumped to a hydrocyclone system which separates the micro-sand from the sludge. The recovered micro-sand is reused in the process. A small quantity of the micro-sand is not recovered by the hydrocyclones and remains within the sludge. The lost micro-sand needs to be replaced periodically by adding more to the process. After micro-sand separation, the sludge is sent to the rock fill structure located in the energy dispenser (expected solid at 0.5% solid depending on TSS feed water quality at a rate of approximately 54m³/h).

2.1.3 Service Water System

The service water system consists of two (2) multimedia filters, two (2) heaters, one (1) filtered water tank and two (2) service water pumps. Service water is used in the preparation of dry chemicals and for polymer makeup systems. Coagulant and polymer require filtered heated water. Treated water from the Actiflo® is used to produce service water.

2.1.4 Reagents

One (1) polymers as well as a coagulant are used to treat the water that flows through the Actiflo®, each is supplied by a dosing system that is adjusted according to the influent flow rate. Treated water from the Actiflo® is used for the mixing of the reagents. The MSDS sheets are provided at Appendix A.

2.1.5 Controls

The Actiflo® Feed Pump a diesel pump working on an ON/OFF mode that allows the flow to be constant during ON mode at 444 m³/h. The flow is monitored on the feed pipe of Actiflo®

The raw water TSS analyzer (turbidity sensor) is used to monitor the water quality. An alarm is triggered when a high-high turbidity is reached. The high-high turbidity alarm value is a setting that will be determined during the commissioning phase and will depend on the quality of the water to be treated.

The effluent water TSS concentration (turbidity) and pH values are monitored continuously with in-line instrumentation. If effluent concentrations reach a set point indicating that final effluent discharge criteria may be exceeded, an alarm is sent to the Operator, who will manage the system to meet effluent criteria. A second alarm is sent to the Operator if effluent concentrations reach a second set point that is just below the final effluent discharge criteria.

Addition of the two (2) required reagents is proportional to the influent water flow. Since this flow is constantly maintained, no manual adjustment is required. If the operator has to modify the influent water flow, adjustment of the reagent dosing system will be required to maintain the target dosage rate. The reagent dosing systems are equipped with pumps that maintain a constant flow rate when running at a constant frequency. The flow can be modified by changing the electric motor frequency.

The reagent dosing system is equipped with valves and graduated cylinders allowing the Operator to measure the addition rate of the reagent using a stop watch. The Operator will determine the required flow of a specific reagent by a formula based on influent flow rate. Based on this calculation, a manual adjustment to the reagent pump will be done in order to obtain the required dosage. Initially, the formula will be based on laboratory testing and will be adjusted accordingly to the treatment plant performance. With time and experience, operation performance may be improved based on the results obtained and sharing practices with other sites such as at Meliadine.

3 OPERATION AND MAINTENANCE

3.1 PUMPING

The system includes mainly pumps for the operation of the CWTP. Some of these pumps are equipped with a VFD that could be adjusted by the Operator or by an automatic system. In all cases the pumps can only be started by the Operator.

All pumps are regularly inspected by the Operator who will ensure the pumps continue to operate efficiently and will address any deficiencies. If the pumps require maintenance, the Operator will report the situation and take appropriate action. Some of the pumps are installed with a standby unit that allows the Operator to switch from one pump to the other if necessary. In some situations, it may be necessary to temporarily shutdown the CWTP for servicing of the equipment.

A preventative maintenance program, as recommended by the pump supplier, will be followed by the Maintenance Crew to ensure the pumps are always kept in good working order.

3.2 REAGENT MIXING

The reagent mixing system is fully automated system. The only requirement is to change the reagent bag when it is empty. Since one bag will last for many days, daily verification of the dry reagent level is sufficient to ensure stable operation of the process.

During the daily inspection, the Operator will monitor the different reagent systems and prepare additional reagent, as required, according to the reagent preparation procedures in place. The water levels in the mixing and distribution tanks are connected to the control system, which will ensure sufficient water is supplied to the reagent preparation systems. In the event of a lack of water supply, a low level alarm will occur to notify the Operator.

Preventive maintenance of the mechanical equipment will be performed according to the supplier operating manual specifications. With time and experience, the maintenance program may be improved based on results obtained and sharing practices with Meliadine.

3.3 EFFLUENT QUALITY CONTROL

The Operator will conduct regular inspections of the entire operating system to ensure it operates as intended. Any upset condition will be reported and corrective actions will be applied accordingly. The operator will also record process key values that will allow the process to be optimized and any discrepancies between the process and expected performances to be detected.

The quality of the final effluent is monitored on a continuous basis by pH and turbidity (Nephelometric Turbidity Unit (NTU)) probes. The turbidity measurement is an indirect indication of the TSS in the water, and will be used to infer the effluent TSS. The output of these instruments will send an alarm indicating that the levels are higher than the set point, but lower than the maximum discharge criteria. This allows the operator to act on the process before the limit is exceeded. In the event that the discharge limit is about to be reached, a second alarm will send a signal to the operator. The system will be equipped with an uninterruptable power supply for instrumentation and controls.

The final effluent will be sampled for water quality following the frequency and parameters stipulated in the MDMER and sent to a certified laboratory for analysis. The results generated by the laboratory will be compared with those obtained with the plant instrumentation to detect any deviations. All the probes and instrumentation within the plant will be calibrated and serviced as per the preventative maintenance program.

As stipulated in the Type A License and the Metal Mining Effluent Regulations (MMER), the final effluent discharged shall not exceed a pH range between 6.0 and 9.5 or a maximum average concentration for TSS of 15 mg/L, and a maximum of 30 mg/L for a grab sample.

3.4 TROUBLESHOOTING AND MAINTENANCE PROCEDURES

The sections below outline the general operational and maintenance procedures at the plant; further details are available in the manufacturer' operating manuals in Appendix B.

The operation of the Actiflo® process is relatively simple and a visual inspection will determine whether the process is performing as expected. A critical component of the process for monitoring is the maturation tank. The agitator of this tank is equipped with a VFD and the speed is adjusted to obtain a gentle mixing in this tank. When the process is operated correctly, big flocs of about 5 mm are visible in the tank and moving slowly. The agitation must be adjusted in a way that the flocs are maintained in suspension and not broken down. The water between the flocs should look clear. If flocs are visible but the water is cloudy, it is an indication that the coagulant dosage is insufficient. If the water is clear but the flocs are small, it is an indication that the flocculant addition is insufficient.

The system must also contain enough micro-sand to obtain flocs that are heavy enough to sink in the clarifier section. If large flocs are visible but are present at the top of the clarifier, this is an indication of insufficient micro-sand. Usually, the micro-sand load is maintained by adding one bag at a time. The frequency of the addition of micro-sand is determined by trial and error. There is no environmental issue with an excessive addition since it would be compensated by an increased loss within the sludge.

The hydrocyclone is also an important part of the system since it allows the micro-sand to be recycled in the system. The underflow of the cyclone should never be blocked and the flow should have an umbrella shape.

3.5 RECORD KEEPING

Records of the operational and maintenance and sampling procedures will be accessible to assist in the evaluation of the CWTP performance. Details of any maintenance undertaken at the CWTP will also be recorded.

The volume, pH, turbidity and temperature of effluent discharged to environment will be recorded on a continuous basis. The data will be saved on a network data base.

3.6 SAFETY PROCEDURES FOR OPERATORS

Operators working in the CWTP facility must be trained prior to work so that they are aware of the health and safety risks as well as the operational procedures associated with the CWTP. The following are important safety considerations:

- Working within the plant, especially with chemicals, requires adequate personal protective equipment (PPE) for Operators. This includes wearing steel toed boots, hard hat, rubber aprons, safety glasses with side shields and gloves.
- Operators are required to conduct good housekeeping of the working area to minimize the risk of incidents.

- Lock-out/tag-out procedures must be applied when servicing equipment.
- The MSDS for reagents used in the CWTP will be readily available for the Operator at all times.
- Eyewash stations are located within proximity of reagent systems in the CWTP.

3.7 CONTROLLING ACCESS TO THE CWTP

Access to the CWTP will be restricted to authorized personnel only. Signs will be posted at the CWTP entrance.

4 EMERGENCY RESPONSE

4.1 FIRE

In case of fire at the CWTP, the on-site emergency response team (ERT) will be notified as per Agnico Eagle's protocol. Instructions from the on-site emergency response team will be followed by all personnel at the CWTP. Further details of fire response are provided in the "*Risk Management & Emergency Response Plan*". The CWTP will include the necessary fire safety protection measures in accordance with the Nunavut and North West Territories Mine Act.

4.2 SPILL

Spill kits and the necessary secondary containment will be provided within the building of the CWTP. In the event of a spill at the CWTP, the Environment Department will be notified immediately and provide support, as required. In the event of a large spill, the on-site ERT will be notified as per Agnico Eagle's protocol. Instructions from the ERT will be followed by all personnel at the CWTP. A spill kit will be available at the CWTP. In accordance with the "*Spill Contingency Plan*", all spills into a waterbody or onto ice are reported immediately to the Nunavut Spill Line among others. For spills occurring away from a waterbody, a report is provided to the Nunavut Spill Line if quantities are above the threshold as specified in the "Nunavut Environmental Protection Act. Consolidation of Spill Contingency Planning and Reporting Regulations R-068-93". Further details regarding the site spill response procedure are provided in the "*Spill Contingency Plan*".

4.3 PLANT MALFUNCTION

If there is a major problem or failure in the CWTP, it will be likely due to a problem with the reagent addition systems caused by the malfunction of the pump or due to a cyclone blockage on the sludge reclaim system.

In the case of an operational upset, the most likely consequence will be an increase of TSS in the effluent. This would be managed by adjusting the feed flow rate, dosage of chemical. Once the problem is resolved and the water quality returns to concentrations within discharge criteria, the valves will be re-opened to allow discharge to environment.

In the case of a cyclone underflow blockage, the micro-sand will be completely lost to the rejected sludge. New sand will then need to be added.

Appendix A: Reagent MSDS Sheets

1. Identification

Product identifier	HYDREX 3267
Other means of identification	None.
Recommended use	Potable Water Treatment
Recommended restrictions	PROFESSIONAL USE ONLY
Manufacturer/Importer/Supplier/Distributor information	
Supplier	Veolia Water Technologies Canada Inc.
Address	2000 Argentia Road, Plaza IV, Suite 430 Mississauga, ON L5N 1W1 Canada
Contact Person	Hydrex Product Specialist
Telephone	(905) 286-4846
Fax	(905) 286-0488
e-mail	vwatcanada-hydrex@veolia.com
24-Hour Emergency telephone	+1-760-476-3962 (Code:333239)
Supplier	Not available.

2. Hazard(s) identification

Physical hazards	Not classified.
Health hazards	Not classified.
Environmental hazards	Hazardous to the aquatic environment, acute Category 3 hazard
Label elements	
Hazard symbol	None.
Signal word	None.
Hazard statement	Harmful to aquatic life.
Precautionary statement	
Prevention	Avoid release to the environment.
Response	Wash hands after handling.
Storage	Store in cool place. Protect from sunlight. Store away from incompatible materials.
Disposal	Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.
Other hazards	None known.
Supplemental information	None.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
ALUMINUM, WATER SOLUBLE SALTS, N.O.S.		39290-78-3	95
Other components below reportable levels			5

All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Skin contact	Wash off with soap and water. Get medical attention if irritation develops and persists.
Eye contact	Do not rub eyes. Rinse with water. Get medical attention if irritation develops and persists.

Material name: HYDREX 3267

2960 Version #: 01 Issue date: 04-20-2017

SDS Canada

Ingestion	Rinse mouth. Get medical attention if symptoms occur.
Most important symptoms/effects, acute and delayed	Dusts may irritate the respiratory tract, skin and eyes.
Indication of immediate medical attention and special treatment needed	Treat symptomatically.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO ₂).
Unsuitable extinguishing media	Not available.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Use water spray to cool unopened containers.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Avoid the generation of dusts during clean-up. Collect dust using a vacuum cleaner equipped with HEPA filter. Prevent product from entering drains. Large Spills: Stop the flow of material, if this is without risk. Shovel the material into waste container. Following product recovery, flush area with water. Small Spills: Sweep up or vacuum up spillage and collect in suitable container for disposal. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid release to the environment. Inform appropriate managerial or supervisory personnel of all environmental releases. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Minimize dust generation and accumulation. Provide appropriate exhaust ventilation at places where dust is formed. Wear appropriate personal protective equipment. Avoid release to the environment. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store in original tightly closed container. Store in a well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. ACGIH Threshold Limit Values

Material	Type	Value	Form
HYDREX 3267	TWA	1 mg/m ³	Respirable fraction.

Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2)

Material	Type	Value
HYDREX 3267	TWA	2 mg/m ³

Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended)

Material	Type	Value	Form
HYDREX 3267	TWA	1 mg/m3	Respirable.

Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents)

Material	Type	Value	Form
HYDREX 3267	TWA	1 mg/m3	Respirable fraction.

Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment)

Material	Type	Value
HYDREX 3267	TWA	2 mg/m3

Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	If material is ground, cut, or used in any operation which may generate dusts, use appropriate local exhaust ventilation to keep exposures below the recommended exposure limits.
Individual protection measures, such as personal protective equipment	
Eye/face protection	Wear safety glasses with side shields (or goggles) and a face shield. Chemical goggles and face shield are recommended. Before any handling, wear protective glasses side-shields complying with the NF EN 166.
Skin protection	
Hand protection	Chemical resistant gloves.
Other	Wear suitable protective clothing. Chemical resistant gloves.
Respiratory protection	Wear respirator with dust filter.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	Powder.
Physical state	Solid.
Form	Powder.
Color	Pale yellow
Odor	Slight
Odor threshold	Not available.
pH	3 - 5 (0.3% solution)
Melting point/freezing point	10.4 °F (-12 °C) (33% solution)
Initial boiling point and boiling range	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	Not available.

Material name: HYDREX 3267

2960 Version #: 01 Issue date: 04-20-2017

SDS Canada

Solubility(ies)	
Solubility (water)	Easily soluble in cold water.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Density	800.00 - 900.00 kg/m3
Explosive properties	Not explosive.
Oxidizing properties	Not oxidizing.
Specific gravity	0.8 - 0.9

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Contact with incompatible materials. None under normal conditions.
Incompatible materials	Ammonia. Chlorine. Do not mix with other chemicals. Alkalies.
Hazardous decomposition products	Aluminum and Sulfur oxides.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Dust may irritate respiratory system.
Skin contact	Dust or powder may irritate the skin.
Eye contact	Dust may irritate the eyes.
Ingestion	Expected to be a low ingestion hazard.

Symptoms related to the physical, chemical and toxicological characteristics	Dusts may irritate the respiratory tract, skin and eyes.
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Information on toxicological effects

Acute toxicity	Not available.
Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization

Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.

Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
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Carcinogenicity	Not available.
------------------------	----------------

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
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Specific target organ toxicity - single exposure	Not classified.
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Specific target organ toxicity - repeated exposure	Not classified.
---	-----------------

Aspiration hazard	Not an aspiration hazard.
--------------------------	---------------------------

12. Ecological information

Ecotoxicity	Harmful to aquatic life.
--------------------	--------------------------

Product	Species		Test Results
HYDREX 3267			
Aquatic			
Crustacea	EC50	Daphnia	91.5789 mg/l, 48 hours estimated
Acute			
Algae	EC50	Algae	14 mg/l, 72 hours OCDE TG 201

* Estimates for product may be based on additional component data not shown.

Persistence and degradability

Bioaccumulative potential No data available.

Mobility in soil No data available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents/container in accordance with local/regional/national/international regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

TDG

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable.

15. Regulatory information

Canadian regulations This product has been classified in accordance with the hazard criteria of the HPR and the SDS contains all the information required by the HPR.

Controlled Drugs and Substances Act

Not regulated.

Export Control List (CEPA 1999, Schedule 3)

Not listed.

Greenhouse Gases

Not listed.

Precursor Control Regulations

Not regulated.

International regulations Additional information is given in the Safety Data Sheet.

Stockholm Convention

Not applicable.

Rotterdam Convention

Not applicable.

Kyoto protocol

Not applicable.

Montreal Protocol

Not applicable.

Basel Convention

Not applicable.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information

Issue date	04-20-2017
Version #	01
Disclaimer	<p>Veolia Water Technologies is not able to anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use and or non respect of Veolia Water Technologies' requirement.</p>
Revision information	<p>Product and Company Identification: Product Review Composition / Information on Ingredients: Ingredients Physical & Chemical Properties: Multiple Properties Toxicological Information: Toxicological Data Ecological Information: Ecotoxicity Regulatory Information: United States GHS: Classification</p>

1. Identification

Identificateur de produit	HYDREX 3267
Autres moyens d'identification	Aucune.
Usage recommandé	Traitement de l'eau potable
Restrictions d'utilisation	USAGE PROFESSIONNEL
Renseignements sur le fabricant/importateur/fournisseur/distributeur	
Fournisseur	Veolia Water Technologies Canada Inc.
Adresse	2000 Argentia Road, Plaza IV, Suite 430 Mississauga, ON L5N 1W1 Canada
Personne à contacter	Hydrex Product Specialist
Téléphone	(905) 286-4846
Télécopieur	(905) 286-0488
courriel	vwatcanada-hydrex@veolia.com
24 Hr Numéro de téléphone d'appel d'urgence	+1-760-476-3962 (Code:333239)
Fournisseur	Non disponible.

2. Identification des dangers

Dangers physiques	Non classé.
Dangers pour la santé	Non classé.
Dangers environnementaux	Dangereux pour le milieu aquatique, danger aigu Catégorie 3
Éléments d'étiquetage	
Symbole de danger	Aucune.
Mention d'avertissement	Aucune.
Mention de danger	Nocif pour les organismes aquatiques.
Conseil de prudence	
Prévention	Éviter le rejet dans l'environnement.
Intervention	Se laver les mains après utilisation.
Stockage	Stocker dans un endroit frais. Protéger du rayonnement solaire. Conserver à l'écart de matières incompatibles.
Élimination	Éliminer le contenu/contenant dans une installation appropriée de traitement et d'élimination conformément aux lois et règlements applicables, ainsi qu'en fonction des caractéristiques du produit au moment de l'élimination.
Autres dangers	Aucun(e) connu(e).
Renseignements supplémentaires	Aucune.

3. Composition/information sur les ingrédients

Mélanges

Dénomination chimique	Nom commun et synonymes	Numéro d'enregistrement CAS	%
ALUMINIUM , WATER SOLUBLE SALTS, n.s.a.		39290-78-3	95
Autres composant sous les niveaux à déclarer			5

Toutes les concentrations sont en pourcentage en poids, sauf si l'ingrédient est un gaz. Les concentrations des gaz sont en pourcentage en volume.

Nom de la matière : HYDREX 3267

2960 Version n°: 01 Date d'émission : 20-Avril-2017

SDS Canada

4. Premiers soins

Inhalation	Transporter à l'extérieur. Appeler un médecin si des symptômes se développent ou persistent
Contact avec la peau	Laver avec de l'eau et du savon. Consulter un médecin si une irritation se développe et persiste.
Contact avec les yeux	Ne pas se frotter les yeux. Rincer avec de l'eau. Consulter un médecin si une irritation se développe et persiste.
Ingestion	Rincer la bouche. Consulter un médecin si des symptômes apparaissent.
Symptômes et effets les plus importants, qu'ils soient aigus ou retardés	La poussière peut irriter les voies respiratoires, la peau et les yeux.
Mention de la nécessité d'une prise en charge médicale immédiate ou d'un traitement spécial, si nécessaire	Traiter de manière symptomatique.
Informations générales	S'assurer que le personnel médical est averti du (des) produits(s) en cause et qu'il prend des mesures pour se protéger.

5. Mesures à prendre en cas d'incendie

Agents extincteurs appropriés	Brouillard d'eau. Mousse. Poudre chimique. Dioxyde de carbone (CO2).
Agents extincteurs inappropriés	Non disponible.
Dangers spécifiques du produit dangereux	Des gaz dangereux pour la santé peuvent se former pendant un incendie.
Équipements de protection spéciaux et précautions spéciales pour les pompiers	Porter un appareil respiratoire autonome et un vêtement de protection complet en cas d'incendie.
Équipement/directives de lutte contre les incendies	Utiliser une pulvérisation d'eau pour refroidir les récipients fermés.
Méthodes particulières d'intervention	Utiliser des procédures standard en cas d'incendie et tenir compte des dangers des autres substances en cause.
Risques d'incendie généraux	Aucun risque inhabituel d'incendie ou d'explosion observé.

6. Mesures à prendre en cas de déversement accidentel

Précautions individuelles, équipements de protection et mesures d'urgence	Tenir à l'écart le personnel non requis. Tenir les gens à l'écart de l'endroit du déversement/de la fuite et en amont du vent. Porter un équipement et des vêtements de protection appropriés durant le nettoyage. S'assurer une ventilation adéquate. Prévenir les autorités locales si des fuites significatives ne peuvent pas être contenues. Pour la protection individuelle, voir la section 8 de la FDS.
Méthodes et matériaux pour le confinement et le nettoyage	Éviter la formation de poussières pendant le nettoyage. Récupérer la poussière en utilisant un aspirateur muni d'un filtre HEPA. Empêcher le produit de pénétrer dans les égouts. Déversements importants : Arrêter l'écoulement de la substance, si cela peut se faire sans risque. Peller le matériau dans un conteneur à déchets. Après avoir récupéré le produit, rincer la zone à l'eau. Déversements peu importants : Balayer ou aspirer le déversement et mettre dans un récipient approprié pour élimination. Pour l'élimination des déchets, voir la section 13 de la FDS.
Précautions relatives à l'environnement	Éviter le rejet dans l'environnement. Informer le personnel de direction et de supervision de tous les rejets dans l'environnement. Empêcher d'autres fuites ou déversements lorsqu'il est possible de le faire en toute sécurité. Éviter le rejet dans les égouts, les cours d'eau ou sur le sol.

7. Manutention et stockage

Précautions relatives à la sûreté en matière de manutention	Minimiser la formation et l'accumulation de poussière. Assurer une ventilation aspirante adéquate aux endroits où la poussière se forme. Porter un équipement de protection individuelle approprié. Éviter le rejet dans l'environnement. Observer de bonnes pratiques d'hygiène industrielle.
Conditions de sûreté en matière de stockage, y compris les incompatibilités	Stocker dans des récipients d'origine fermés de manière étanche. Stocker dans un endroit bien ventilé. Stocker à l'écart des matériaux incompatibles (Consulter la section 10 de la FDS).

8. Contrôle de l'exposition/protection individuelle

Limites d'exposition professionnelle

ÉTATS-UNIS. Valeurs limites d'exposition de l'ACGIH

Substance	Type	Valeur	Forme
HYDREX 3267	TWA	1 mg/m3	Fraction respirable.

Canada. LEMT pour l'Alberta (Code de l'hygiène et de la sécurité au travail, Annexe 1, Tableau 2)

Substance	Type	Valeur
HYDREX 3267	TWA	2 mg/m3

Canada. LEMT pour la Colombie-Britannique. (Valeurs limites d'exposition en milieu de travail pour les substances chimiques, Réglementation sur la santé et sécurité au travail 296/97, ainsi modifiée)

Substance	Type	Valeur	Forme
HYDREX 3267	TWA	1 mg/m3	Respirable.

Canada. LEMT pour l'Ontario. (Contrôle de l'exposition à des agents biologiques et chimiques)

Substance	Type	Valeur	Forme
HYDREX 3267	TWA	1 mg/m3	Fraction respirable.

Canada. LEMT du Québec, (Ministère du Travail. Règlement sur la qualité du milieu de travail)

Substance	Type	Valeur
HYDREX 3267	TWA	2 mg/m3

Valeurs biologiques limites

Aucune limite d'exposition biologique observée pour les ingrédients.

Contrôles d'ingénierie appropriés

Si le matériau est moulu, coupé ou utilisé dans toute opération susceptible de créer des poussières, utiliser une ventilation locale par aspiration appropriée pour maintenir les expositions sous les limites d'exposition recommandées.

Mesures de protection individuelle, telles que les équipements de protection individuelle

Protection du visage/des yeux

Porter des lunettes de sécurité à écrans latéraux (ou des lunettes à coques) et un écran facial. Il est recommandé de porter des lunettes de protection chimique et un écran facial. Avant toute manipulation, il est nécessaire de porter des lunettes à protection latérale conformes à la norme NF EN 166.

Protection de la peau

Protection des mains

Gants résistants aux produits chimiques.

Autre

Porter un vêtement de protection approprié. Gants résistants aux produits chimiques.

Protection respiratoire

Porter un appareil respiratoire muni de filtres antipoussière.

Dangers thermiques

Porter des vêtements de protection thermique appropriés, au besoin.

Considérations d'hygiène générale

Toujours adopter de bonnes pratiques d'hygiène personnelle, comme se laver après avoir manipulé la substance et avant de manger, de boire ou de fumer. Laver régulièrement les vêtements de travail et l'équipement de protection pour éliminer les contaminants

9. Propriétés physiques et chimiques

Apparence

Poudre.

État physique

Solide.

Forme

Poudre.

Couleur

Jaune pâle

Odeur

Léger

Seuil olfactif

Non disponible.

pH

3 - 5 (0.3% solution)

Point de fusion et point de congélation

-12 °C (10.4 °F) (33% solution)

Point initial d'ébullition et domaine d'ébullition

Non disponible.

Point d'éclair

Non disponible.

Taux d'évaporation

Non disponible.

Inflammabilité (solides et gaz)	Non disponible.
Limites supérieures et inférieures d'inflammabilité ou d'explosibilité	
Limites d'inflammabilité - inférieure (%)	Non disponible.
Limites d'inflammabilité - supérieure (%)	Non disponible.
Limite d'explosibilité - inférieure (%)	Non disponible.
Limite d'explosibilité - supérieure (%)	Non disponible.
Tension de vapeur	Non disponible.
Densité de vapeur	Non disponible.
Densité relative	Non disponible.
Solubilité	
Solubilité (eau)	Facilement soluble dans l'eau froide.
Coefficient de partage n-octanol/eau	Non disponible.
Température d'auto-inflammation	Non disponible.
Température de décomposition	Non disponible.
Viscosité	Non disponible.
Autres informations	
Densité	800.00 - 900.00 kg/m3
Propriétés explosives	Non explosif.
Propriétés comburantes	Non oxydant.
Densité	0.8 - 0.9

10. Stabilité et réactivité

Réactivité	Le produit est stable et non réactif dans des conditions normales d'utilisation, d'entreposage et de transport.
Stabilité chimique	La substance est stable dans des conditions normales.
Risque de réactions dangereuses	Aucune réaction dangereuse connue dans des conditions normales d'utilisation.
Conditions à éviter	Contact avec des matériaux incompatibles. Aucun(e) dans des conditions normales.
Matériaux incompatibles	Ammoniac. Chlore Ne pas mélanger avec d'autres produits chimiques. Alcalis.
Produits de décomposition dangereux	Aluminium et Oxydes de soufre.

11. Données toxicologiques

Renseignements sur les voies d'exposition probables

Inhalation	La poussière peut irriter l'appareil respiratoire.
Contact avec la peau	La poussière ou la poudre peut irriter la peau.
Contact avec les yeux	La poussière peut irriter les yeux.
Ingestion	Faible danger présumé en cas d'ingestion.
Les symptômes correspondant aux caractéristiques physiques, chimiques et toxicologiques	La poussière peut irriter les voies respiratoires, la peau et les yeux.

Renseignements sur les effets toxicologiques

Toxicité aiguë	Non disponible.
Corrosion cutanée/irritation cutanée	Un contact prolongé avec la peau peut causer une irritation temporaire.

Lésions oculaires graves/irritation oculaire	Le contact direct avec les yeux peut causer une irritation temporaire.
Sensibilisation respiratoire ou cutanée	
Sensibilisation respiratoire	Pas un sensibilisant respiratoire.
Sensibilisation cutanée	On ne s'attend pas à ce que ce produit provoque une sensibilisation cutanée.
Mutagenicité sur les cellules germinales	Il n'existe pas de données qui indiquent que ce produit, ou tout composant présent à des taux de plus de 0,1 %, soit mutagène ou génétoxique.
Cancérogénicité	Non disponible.
Toxicité pour la reproduction	On ne s'attend pas à ce que ce produit présente des effets sur la reproduction ou le développement.
Toxicité pour certains organes cibles - exposition unique	Non classé.
Toxicité pour certains organes cibles - expositions répétées	Non classé.
Danger par aspiration	Pas un danger par aspiration.

12. Données écologiques

Écotoxicité	Nocif pour les organismes aquatiques.		
Produit	Espèces		Résultats d'épreuves
HYDREX 3267			
Aquatique			
Crustacés	CE50	Daphnia	91.5789 mg/l, 48 heures estimation
<i>Aiguë</i>			
Algues	CE50	Algues	14 mg/l, 72 heures OCDE TG 201

* Les estimations pour le produit peuvent être basées sur d'autres données de composants non montrées.

Persistence et dégradation

Potentiel de bioaccumulation	Aucune donnée disponible.
Mobilité dans le sol	Aucune donnée disponible.
Autres effets nocifs	On ne s'attend pas à ce que ce composant ait des effets néfastes sur l'environnement (par ex., appauvrissement de la couche d'ozone, potentiel de formation photochimique d'ozone, perturbation endocrinienne, potentiel de réchauffement de la planète).

13. Données sur l'élimination

Instructions pour l'élimination	Recueillir et réutiliser ou éliminer dans des récipients scellés dans un site d'élimination des déchets autorisé. Ne pas laisser la substance s'infiltrer dans les égouts/les conduits d'alimentation en eau. Ne pas contaminer les étangs, les voies navigables ou les fossés avec le produit ou le récipient utilisés. Éliminer le contenu/récipient conformément à la réglementation locale/régionale/nationale/internationale.
Règlements locaux d'élimination	Détruire conformément à toutes les réglementations applicables.
Code des déchets dangereux	Les codes de déchets doivent être attribués dans le cadre d'une consultation entre l'utilisateur, le fabricant et l'entreprise de décharge.
Déchets des résidus / produits non utilisés	Éliminer conformément à la réglementation locale. Les récipients ou pochettes vides peuvent conserver certains résidus de produit. Éliminer ce produit et son récipient d'une manière sûre (voir : instructions d'élimination).
Emballages contaminés	Comme les récipients vides peuvent contenir un résidu du produit, suivre les avertissements de l'étiquette, même une fois le récipient vide. Les contenants vides doivent être acheminés vers une installation certifiée de traitement des déchets en vue de leur élimination ou recyclage.

14. Informations relatives au transport

TMD

N'entre pas dans la réglementation des marchandises dangereuses.

IATA

N'entre pas dans la réglementation des marchandises dangereuses.

IMDG

N'entre pas dans la réglementation des marchandises dangereuses.

**Transport en vrac selon
l'Annexe II de MARPOL 73/78
et le recueil IBC**

Sans objet.

15. Informations sur la réglementation

Réglementation canadienne Ce produit a été classé conformément aux critères de danger énoncés dans le Règlement sur les produits dangereux et la FDS contient tous les renseignements exigés par le Règlement sur les produits dangereux.

Loi réglementant certaines drogues et autres substances

Non réglementé.

Liste des marchandises d'exportation contrôlée (LCPE 1999, Annexe 3)

Non inscrit.

Gaz à effet de serre

Non inscrit.

Règlements sur les précurseurs

Non réglementé.

Règlements internationaux Renseignements supplémentaires fournis sur la fiche de données de sécurité.

Convention de Stockholm

Sans objet.

Convention de Rotterdam

Sans objet.

Protocole de Kyoto

Sans objet.

Protocole de Montréal

Sans objet.

Convention de Bâle

Sans objet.

Inventaires Internationaux

Pays ou région	Nom de l'inventaire	En stock (Oui/Non)*
Australie	Inventaire australien des substances chimiques (AICS)	Non
Canada	Liste intérieure des substances (LIS)	Oui
Canada	Liste extérieure des substances (LES)	Non
Chine	Inventaire des substances chimiques existantes en Chine (IECSC)	Oui
Europe	Inventaire européen des substances chimiques commerciales existantes (EINECS)	Oui
Europe	Liste européenne des substances chimiques notifiées (ELINCS)	Non
Japon	Inventaire des substances chimiques existantes et nouvelles (ENCS)	Non
Corée	Liste des produits chimiques existants (ECL)	Oui
Nouvelle-Zélande	Inventaire de la Nouvelle-Zélande	Non
Philippines	Inventaire philippin des produits et substances chimiques (PICCS)	Non
États-Unis et Porto Rico	Inventaire du TSCA (Toxic Substances Controls Act - Loi réglementant les substances toxiques)	Oui

*La réponse « Oui » indique que tous les composants du produit sont conformes aux exigences d'entreposage du pays ayant compétence. Un « Non » indique qu'un ou plusieurs composant(s) du produit n'est/ne sont pas inscrit(s) ou exempt(s) d'une inscription sur l'inventaire administré par le(s) pays ayant compétence.

16. Autres informations

Date de publication 20-Avril-2017

Version n° 01

Nom de la matière : HYDREX 3267

2960 Version n°: 01 Date d'émission : 20-Avril-2017

SDS Canada

Avis de non-responsabilité

Veolia Water Solutions & Technologies ne peut prévoir toutes les conditions d'utilisation des présents renseignements et de son produit, ou des produits d'autres fabricants en association avec son produit. L'utilisateur est responsable d'assurer des conditions sécuritaires de manutention, d'entreposage et d'élimination du produit, et il assume toute responsabilité quant à des pertes, des blessures, des dommages ou des dépenses liés à une utilisation incorrecte ou au non-respect des exigences de Veolia Solutions & Technologies.

Informations relatives à la révision

Identification du produit et de l'entreprise : Identification du produit et de l'entreprise
Composition / renseignements sur les ingrédients : Sommaire des composants
Propriétés physiques et chimiques : Propriétés multiples
Données toxicologiques : Données toxicologiques
Données écologiques: Effets écotoxicologiques
Données réglementaires: États-Unis
GHS: Classification

Coagulant

Water Clarification - Polyaluminum Chloride

Description and Use

Hydrex 3267 is a highly effective polyaluminum chloride based coagulant, supplied in solid form. This product provides a most concentrated form of active aluminum and is a cost-efficient approach where bulk delivery of liquid product is not an option.

Advantages

Hydrex 3267 provides the performance well associated with polyaluminum chloride coagulant chemistry in a most concentrated form. Reduced transportation costs, the elimination of bulk storage footprint or the elimination of tote IBC management issues are benefits associated with this form of polyaluminum chloride.

Application Information

Hydrex 3267 is rehydrated to a 33 percent (by weight) solution, prior to dosing to the system. Contact your Hydrex representative to provide verification of the active aluminum concentration of this solution.

Rehydration of Hydrex 3267 to a 33% solution should be performed with the highest quality water available. Dissolution is best achieved through use of warm water to a temperature limit of 70 degrees celsius. While complete dissolution is attainable at lower temperature, additional mixing time may be required. Take care to add the dry Hydrex 3267 in a controlled flow of the powder. Avoid "dumping" large mass of Hydrex 3267 that is disproportionately greater to the mass of dilution water.

Hydrex 3267 is to be stored in a cool, dry location. Keep shipping containers unopened until required for use. For best results, Hydrex 3267 should be stored in conditions in which relative humidity does not exceed 30%. Storage temperature should not exceed 30 degrees celsius. Environmental control systems are recommended for optimal product performance.

Coagulant

Water Clarification - Polyaluminum Chloride

Specifications

Physical Form :	Solid (powder)
Bulk Density :	800 to 900 kg/m ³
Specific Gravity (g/cm ³) @ 25°C :	1.1 to 1.3 (as 33% solution)
Product pH :	3.0 to 5.0 (as 33% solution)
Color :	Pale Yellow
Freezing Point (°C/°F) :	Not Applicable
Solubility :	Complete (30 minutes in most cases)

Materials Compatibility

Solution tanks, piping and all wetted components should be constructed from a selection including teflon or cross-linked polyethylene. Hydrex 3267 is mildly corrosive. Avoid use of mild steel, copper, aluminum and stainless steel in contact with the solution.

Storage of the the dry Hydrex 3267 in stainless steel is acceptable.

Packaging

Hydrex 3267 is available in 25 kags or 800 kilogram supersacs.

Safety Information

Refer to the product Material Safety Data Sheet before use.

Polychlorure d'aluminium en poudre

Applications

L'HYDREX 3267 est un polychlorure d'aluminium parmi les plus performant.

Ce coagulant de haute pureté, partiellement neutralisé et polymérisé, permet d'obtenir d'excellentes performances dans le traitement des eaux potables, usées et industrielles.

Avantages

L'HYDREX 3267 amène une réduction du volume de boues, une diminution des produits correcteurs de pH, une meilleure qualité d'eau finie et des performances accrues en eaux froides.

L'HYDREX 3267 réagit particulièrement bien dans les procédés ou applications de filtration directe, de maturation des filtres, de décantation lestée, ou sur des eaux à très faibles ou très fortes turbidités.

L'utilisation du L'HYDREX 3267 en poudre permet de réduire les coûts de transport et de faciliter l'entreposage dans des conditions froides.

Mise en œuvre

DOSAGE

L'HYDREX 3267 peut être remis en solution. Afin d'obtenir une concentration de 5,3% Al (solution originale), ajouter en rapport massique 1 partie de HYDREX 3267 à 2 parties d'eau. Ajouter graduellement la poudre à l'eau tout en mélangeant.

Polychlorure d'aluminium en poudre

Spécifications

SPÉCIFICATIONS – CANADA

Apparence :	Poudre jaune pâle,hygroscopique
Aluminium (Al) :	>15,9%
Al ₂ O ₃ (%) :	>30%
Basicité :	51 ± 4%
Sulfates (SO ₄) :	9,0 ± 0,5%
Densité de vrac :	0, 85 ± 0,05
Humidité (%) :	4,50 ± 2,0%

TYPIQUEMENT pour une solution de 33%

pH (0,3% massique)	4,3 ± 0,7
Basicité (%)	50%
Densité relative	1,23 kg/L
Point de congélation	-12° C / 10° F

Compatibilité Matériels

Le Kemira STERNPAC DRY devrait être entreposé dans un endroit sec.

Protéger de l'humidité

Conditionnement

Sur demande

Sécurité

La manipulation de tous produits chimiques demande de la précaution.

Quiconque est responsable de l'utilisation et de la manipulation de L'HYDREX 3267 devrait se familiariser avec les consignes de sécurité détaillées dans notre fiche signalétique.

1. Identification

Product identifier	Hydrex 3613
Other means of identification	None.
Recommended use	Potable Water Flocculant
Recommended restrictions	PROFESSIONAL USE ONLY
Manufacturer/Importer/Supplier/Distributor information	
Supplier	Veolia Water Technologies Canada Inc.
Address	2000 Argentia Road, Plaza IV, Suite 430 Mississauga, ON L5N 1W1 Canada
Contact Person	Hydrex Product Specialist
Telephone	(905) 286-4846
Fax	(905) 286-0488
e-mail	vwatcanada-hydrex@veolia.com
24-Hour Emergency telephone	+1-760-476-3962 (Code:333239)
Supplier	Not available.

2. Hazard(s) identification

Physical hazards	Not classified.
Health hazards	Not classified.
Environmental hazards	Not classified.
Label elements	
Hazard symbol	None.
Signal word	None.
Hazard statement	The mixture does not meet the criteria for classification.
Precautionary statement	
Prevention	Observe good industrial hygiene practices.
Response	Wash hands after handling.
Storage	Store in cool place. Protect from sunlight. Store away from incompatible materials.
Disposal	Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.
Other hazards	None known.
Supplemental information	None.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
ADIPIC ACID		124-04-9	1 - < 3
Other components below reportable levels			90 - 100

All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Skin contact	Wash off with soap and water. Get medical attention if irritation develops and persists.
Eye contact	Do not rub eyes. Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed	Dusts may irritate the respiratory tract, skin and eyes.
Indication of immediate medical attention and special treatment needed	Treat symptomatically.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO ₂).
Unsuitable extinguishing media	Not available.
Specific hazards arising from the chemical	Material can be slippery when wet. During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Use water spray to cool unopened containers.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Wear appropriate protective equipment and clothing during clean-up. For personal protection, see section 8 of the SDS. Slippery when wet.
Methods and materials for containment and cleaning up	Avoid the generation of dusts during clean-up. Collect dust using a vacuum cleaner equipped with HEPA filter. Stop the flow of material, if this is without risk. Large Spills: Wet down with water and dike for later disposal. Shovel the material into waste container. Following product recovery, flush area with water. Small Spills: Sweep up or vacuum up spillage and collect in suitable container for disposal. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Minimize dust generation and accumulation. Provide appropriate exhaust ventilation at places where dust is formed. Material can be slippery when wet. Practice good housekeeping.
Conditions for safe storage, including any incompatibilities	Store in original tightly closed container. Store in a well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	If material is ground, cut, or used in any operation which may generate dusts, use appropriate local exhaust ventilation to keep exposures below the recommended exposure limits.
Individual protection measures, such as personal protective equipment	
Eye/face protection	Wear safety glasses with side shields (or goggles) and a face shield. Chemical goggles and face shield are recommended. Before any handling, wear protective glasses side-shields complying with the NF EN 166.
Skin protection	
Hand protection	Chemical resistant gloves.
Other	Wear suitable protective clothing. Chemical resistant gloves.
Respiratory protection	Wear respirator with dust filter.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations

Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	Granular or Powder.
Physical state	Solid.
Form	Powder.
Color	Off-white.
Odor	Not available.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Not available.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Density	0.70 - 0.80 g/cm3
Explosive properties	Not explosive.
Oxidizing properties	Not oxidizing.
pH of 1% Solution	3 - 5

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions. Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Contact with incompatible materials. None under normal conditions.
Incompatible materials	Oxygen.
Hazardous decomposition products	No dangerous reaction known under conditions of normal use. At thermal decomposition temperatures, carbon monoxide and carbon dioxide. Ammonia. Nitrogen oxides (NOx). Hydrogen chloride.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Dust may irritate respiratory system.
Skin contact	Dust or powder may irritate the skin.
Eye contact	Dust may irritate the eyes.
Ingestion	Expected to be a low ingestion hazard.

Symptoms related to the physical, chemical and toxicological characteristics Dusts may irritate the respiratory tract, skin and eyes.

Information on toxicological effects

Acute toxicity Not known.

Product	Species	Test Results
Hydrex 3613		
Acute		
Oral		
LD50	Rat	> 5000 mg/kg

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation Prolonged skin contact may cause temporary irritation.

Serious eye damage/eye irritation Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization

Respiratory sensitization Not a respiratory sensitizer.

Skin sensitization This product is not expected to cause skin sensitization.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity Not available.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure Not classified.

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard Not an aspiration hazard.

Further information This product has no known adverse effect on human health.

12. Ecological information

Ecotoxicity The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Product	Species	Test Results
Hydrex 3613		
Aquatic		
Crustacea	EC50 Daphnia	> 10 mg/l, 48 hr
Fish	LC50 Fish	3880 mg/l, 96 hours estimated

* Estimates for product may be based on additional component data not shown.

Persistence and degradability

Bioaccumulative potential

Mobility in soil No data available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

TDG

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Not applicable.

Annex II of MARPOL 73/78 and the IBC Code

15. Regulatory information

Canadian regulations This product has been classified in accordance with the hazard criteria of the HPR and the SDS contains all the information required by the HPR.

Controlled Drugs and Substances Act

Not regulated.

Export Control List (CEPA 1999, Schedule 3)

Not listed.

Greenhouse Gases

Not listed.

Precursor Control Regulations

Not regulated.

International regulations

Additional information is given in the Safety Data Sheet.

Stockholm Convention

Not applicable.

Rotterdam Convention

Not applicable.

Kyoto protocol

Not applicable.

Montreal Protocol

Not applicable.

Basel Convention

Not applicable.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No

Country(s) or region	Inventory name	On inventory (yes/no)*
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information

Issue date	04-20-2017
Version #	01
Disclaimer	Veolia Water Technologies is not able to anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use and or non respect of Veolia Water Technologies' requirement.
Revision information	Product and Company Identification: Product Review Hazards Identification: US Hazardous Composition / Information on Ingredients: Ingredients Toxicological Information: Toxicological Data Regulatory Information: United States GHS: Classification

1. Identification

Identificateur de produit	Hydrex 3613
Autres moyens d'identification	Aucune.
Usage recommandé	Floculant pour eau potable
Restrictions d'utilisation	USAGE PROFESSIONNEL
Renseignements sur le fabricant/importateur/fournisseur/distributeur	
Fournisseur	Veolia Water Technologies Canada Inc.
Adresse	2000 Argentia Road, Plaza IV, Suite 430 Mississauga, ON L5N 1W1 Canada
Personne à contacter	Hydrex Product Specialist
Téléphone	(905) 286-4846
Télécopieur	(905) 286-0488
courriel	vwatcanada-hydrex@veolia.com
24 Hr Numéro de téléphone d'appel d'urgence	+1-760-476-3962 (Code:333239)
Fournisseur	Non disponible.

2. Identification des dangers

Dangers physiques	Non classé.
Dangers pour la santé	Non classé.
Dangers environnementaux	Non classé.
Éléments d'étiquetage	
Symbole de danger	Aucune.
Mention d'avertissement	Aucune.
Mention de danger	Le mélange ne satisfait pas les critères de classification.
Conseil de prudence	
Prévention	Observer de bonnes pratiques d'hygiène industrielle.
Intervention	Se laver les mains après utilisation.
Stockage	Stocker dans un endroit frais. Protéger du rayonnement solaire. Conserver à l'écart de matières incompatibles.
Élimination	Éliminer le contenu/contenant dans une installation appropriée de traitement et d'élimination conformément aux lois et règlements applicables, ainsi qu'en fonction des caractéristiques du produit au moment de l'élimination.
Autres dangers	Aucun(e) connu(e).
Renseignements supplémentaires	Aucune.

3. Composition/information sur les ingrédients

Mélanges

Dénomination chimique	Nom commun et synonymes	Numéro d'enregistrement CAS	%
ACIDE ADIPIQUE		124-04-9	1 - < 3
Autres composant sous les niveaux à déclarer			90 - 100

Toutes les concentrations sont en pourcentage en poids, sauf si l'ingrédient est un gaz. Les concentrations des gaz sont en pourcentage en volume.

4. Premiers soins

Inhalation	Transporter à l'extérieur. Appeler un médecin si des symptômes se développent ou persistent
Contact avec la peau	Laver avec de l'eau et du savon. Consulter un médecin si une irritation se développe et persiste.
Contact avec les yeux	Ne pas se frotter les yeux. Rincer avec de l'eau. Consulter un médecin si une irritation se développe et persiste.
Ingestion	Rincer la bouche. Consulter un médecin si des symptômes apparaissent.
Symptômes et effets les plus importants, qu'ils soient aigus ou retardés	La poussière peut irriter les voies respiratoires, la peau et les yeux.
Mention de la nécessité d'une prise en charge médicale immédiate ou d'un traitement spécial, si nécessaire	Traiter de manière symptomatique.
Informations générales	S'assurer que le personnel médical est averti du (des) produits(s) en cause et qu'il prend des mesures pour se protéger.

5. Mesures à prendre en cas d'incendie

Agents extincteurs appropriés	Brouillard d'eau. Mousse. Poudre chimique. Dioxyde de carbone (CO2).
Agents extincteurs inappropriés	Non disponible.
Dangers spécifiques du produit dangereux	Le matériau peut être glissant lorsque mouillé. Des gaz dangereux pour la santé peuvent se former pendant un incendie.
Équipements de protection spéciaux et précautions spéciales pour les pompiers	Porter un appareil respiratoire autonome et un vêtement de protection complet en cas d'incendie.
Équipement/directives de lutte contre les incendies	Utiliser une pulvérisation d'eau pour refroidir les récipients fermés.
Méthodes particulières d'intervention	Utiliser des procédures standard en cas d'incendie et tenir compte des dangers des autres substances en cause.
Risques d'incendie généraux	Aucun risque inhabituel d'incendie ou d'explosion observé.

6. Mesures à prendre en cas de déversement accidentel

Précautions individuelles, équipements de protection et mesures d'urgence	Tenir à l'écart le personnel non requis. Porter un équipement et des vêtements de protection appropriés durant le nettoyage. Pour la protection individuelle, voir la section 8 de la FDS. Glissant lorsque mouillé.
Méthodes et matériaux pour le confinement et le nettoyage	Éviter la formation de poussières pendant le nettoyage. Récupérer la poussière en utilisant un aspirateur muni d'un filtre HEPA. Arrêter l'écoulement de la substance, si cela peut se faire sans risque. Déversements importants : Mouiller avec de l'eau et endiguer pour une élimination ultérieure. Pelleter le matériau dans un conteneur à déchets. Après avoir récupéré le produit, rincer la zone à l'eau. Déversements peu importants : Balayer ou aspirer le déversement et mettre dans un récipient approprié pour élimination. Pour l'élimination des déchets, voir la section 13 de la FDS.
Précautions relatives à l'environnement	Éviter le rejet dans les égouts, les cours d'eau ou sur le sol.

7. Manutention et stockage

Précautions relatives à la sûreté en matière de manutention	Minimiser la formation et l'accumulation de poussière. Assurer une ventilation aspirante adéquate aux endroits où la poussière se forme. Le matériau peut être glissant lorsque mouillé. Assurer un bon entretien ménager.
Conditions de sûreté en matière de stockage, y compris les incompatibilités	Stocker dans des récipients d'origine fermés de manière étanche. Stocker dans un endroit bien ventilé. Stocker à l'écart des matériaux incompatibles (Consulter la section 10 de la FDS).

8. Contrôle de l'exposition/protection individuelle

Limites d'exposition professionnelle	Il n'y a pas de limites d'exposition pour ce ou ces ingrédients.
Valeurs biologiques limites	Aucune limite d'exposition biologique observée pour les ingrédients.
Contrôles d'ingénierie appropriés	Si le matériau est moulu, coupé ou utilisé dans toute opération susceptible de créer des poussières, utiliser une ventilation locale par aspiration appropriée pour maintenir les expositions sous les limites d'exposition recommandées.
Mesures de protection individuelle, telles que les équipements de protection individuelle	
Protection du visage/des yeux	Porter des lunettes de sécurité à écrans latéraux (ou des lunettes à coques) et un écran facial. Il est recommandé de porter des lunettes de protection chimique et un écran facial. Avant toute manipulation, il est nécessaire de porter des lunettes à protection latérale conformes à la norme NF EN 166.
Protection de la peau	
Protection des mains	Gants résistants aux produits chimiques.
Autre	Porter un vêtement de protection approprié. Gants résistants aux produits chimiques.
Protection respiratoire	Porter un appareil respiratoire muni de filtres antipoussière.
Dangers thermiques	Porter des vêtements de protection thermique appropriés, au besoin.
Considérations d'hygiène générale	Toujours adopter de bonnes pratiques d'hygiène personnelle, comme se laver après avoir manipulé la substance et avant de manger, de boire ou de fumer. Laver régulièrement les vêtements de travail et l'équipement de protection pour éliminer les contaminants

9. Propriétés physiques et chimiques

Apparence	Granuleux. ou Poudre.
État physique	Solide.
Forme	Poudre.
Couleur	Blanc cassé.
Odeur	Non disponible.
Seuil olfactif	Non disponible.
pH	Non disponible.
Point de fusion et point de congélation	Non disponible.
Point initial d'ébullition et domaine d'ébullition	Non disponible.
Point d'éclair	Non disponible.
Taux d'évaporation	Non disponible.
Inflammabilité (solides et gaz)	Non disponible.
Limites supérieures et inférieures d'inflammabilité ou d'explosibilité	
Limites d'inflammabilité - inférieure (%)	Non disponible.
Limites d'inflammabilité - supérieure (%)	Non disponible.
Limite d'explosibilité - inférieure (%)	Non disponible.
Limite d'explosibilité - supérieure (%)	Non disponible.
Tension de vapeur	Non disponible.
Densité de vapeur	Non disponible.
Densité relative	Non disponible.
Solubilité	
Solubilité (eau)	Non disponible.

Coefficient de partage n-octanol/eau	Non disponible.
Température d'auto-inflammation	Non disponible.
Température de décomposition	Non disponible.
Viscosité	Non disponible.
Autres informations	
Densité	0.70 - 0.80 g/cm3
Propriétés explosives	Non explosif.
Propriétés comburantes	Non oxydant.
pH (solution à 1%)	3 - 5

10. Stabilité et réactivité

Réactivité	Le produit est stable et non réactif dans des conditions normales d'utilisation, d'entreposage et de transport.
Stabilité chimique	La substance est stable dans des conditions normales. La substance est stable dans des conditions normales.
Risque de réactions dangereuses	Une polymérisation dangereuse ne se produit pas.
Conditions à éviter	Contact avec des matériaux incompatibles. Aucun(e) dans des conditions normales.
Matériaux incompatibles	Oxygène.
Produits de décomposition dangereux	Aucune réaction dangereuse connue dans des conditions normales d'utilisation. Aux températures de décomposition thermique, du monoxyde et du dioxyde de carbone. Ammoniac. Oxydes d'azote (NOx). Chlorure d'hydrogène.

11. Données toxicologiques

Renseignements sur les voies d'exposition probables

Inhalation	La poussière peut irriter l'appareil respiratoire.
Contact avec la peau	La poussière ou la poudre peut irriter la peau.
Contact avec les yeux	La poussière peut irriter les yeux.
Ingestion	Faible danger présumé en cas d'ingestion.
Les symptômes correspondant aux caractéristiques physiques, chimiques et toxicologiques	La poussière peut irriter les voies respiratoires, la peau et les yeux.

Renseignements sur les effets toxicologiques

Toxicité aiguë Inconnu(e).

Produit	Espèces	Résultats d'épreuves
Hydrex 3613		
Aiguë		
Orale		
DL50	Rat	> 5000 mg/kg

* Les estimations pour le produit peuvent être basées sur d'autres données de composants non montrées.

Corrosion cutanée/irritation cutanée Un contact prolongé avec la peau peut causer une irritation temporaire.

Lésions oculaires graves/irritation oculaire Le contact direct avec les yeux peut causer une irritation temporaire.

Sensibilisation respiratoire ou cutanée

Sensibilisation respiratoire Pas un sensibilisant respiratoire.

Sensibilisation cutanée On ne s'attend pas à ce que ce produit provoque une sensibilisation cutanée.

Mutagenicité sur les cellules germinales Il n'existe pas de données qui indiquent que ce produit, ou tout composant présent à des taux de plus de 0,1 %, soit mutagène ou génotoxique.

Cancérogénicité	Non disponible.
Toxicité pour la reproduction	On ne s'attend pas à ce que ce produit présente des effets sur la reproduction ou le développement.
Toxicité pour certains organes cibles - exposition unique	Non classé.
Toxicité pour certains organes cibles - expositions répétées	Non classé.
Danger par aspiration	Pas un danger par aspiration.
Autres informations	Ce produit n'est associé à aucun effet néfaste connu pour la santé humaine.

12. Données écologiques

Écotoxicité	Le produit n'est pas classé comme dangereux pour l'environnement. Toutefois, ceci n'exclut pas la possibilité que des déversements importants ou fréquents puissent avoir un effet nocif ou nuisible sur l'environnement.
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Produit	Espèces	Résultats d'épreuves
Hydrex 3613		
Aquatique		
Crustacés	CE50	Daphnia > 10 mg/l, 48 hr
Poisson	CL50	Poisson 3880 mg/l, 96 heures estimation

* Les estimations pour le produit peuvent être basées sur d'autres données de composants non montrées.

Persistance et dégradation

Potentiel de bioaccumulation

Mobilité dans le sol Aucune donnée disponible.

Autres effets nocifs On ne s'attend pas à ce que ce composant ait des effets néfastes sur l'environnement (par ex., appauvrissement de la couche d'ozone, potentiel de formation photochimique d'ozone, perturbation endocrinienne, potentiel de réchauffement de la planète).

13. Données sur l'élimination

Instructions pour l'élimination	Recueillir et réutiliser ou éliminer dans des récipients scellés dans un site d'élimination des déchets autorisé.
Règlements locaux d'élimination	Détruire conformément à toutes les réglementations applicables.
Code des déchets dangereux	Les codes de déchets doivent être attribués dans le cadre d'une consultation entre l'utilisateur, le fabricant et l'entreprise de décharge.
Déchets des résidus / produits non utilisés	Éliminer conformément à la réglementation locale. Les récipients ou pochettes vides peuvent conserver certains résidus de produit. Éliminer ce produit et son récipient d'une manière sûre (voir : instructions d'élimination).
Emballages contaminés	Comme les récipients vides peuvent contenir un résidu du produit, suivre les avertissements de l'étiquette, même une fois le récipient vide. Les contenants vides doivent être acheminés vers une installation certifiée de traitement des déchets en vue de leur élimination ou recyclage.

14. Informations relatives au transport

TMD

N'entre pas dans la réglementation des marchandises dangereuses.

IATA

N'entre pas dans la réglementation des marchandises dangereuses.

IMDG

N'entre pas dans la réglementation des marchandises dangereuses.

Transport en vrac selon l'Annexe II de MARPOL 73/78 et le recueil IBC Sans objet.

15. Informations sur la réglementation

Réglementation canadienne Ce produit a été classé conformément aux critères de danger énoncés dans le Règlement sur les produits dangereux et la FDS contient tous les renseignements exigés par le Règlement sur les produits dangereux.

Loi réglementant certaines drogues et autres substances

Non réglementé.

Liste des marchandises d'exportation contrôlée (LCPE 1999, Annexe 3)

Non inscrit.

Gaz à effet de serre

Non inscrit.

Règlements sur les précurseurs

Non réglementé.

Règlements internationaux Renseignements supplémentaires fournis sur la fiche de données de sécurité.

Convention de Stockholm

Sans objet.

Convention de Rotterdam

Sans objet.

Protocole de Kyoto

Sans objet.

Protocole de Montréal

Sans objet.

Convention de Bâle

Sans objet.

Inventaires Internationaux

Pays ou région	Nom de l'inventaire	En stock (Oui/Non)*
Australie	Inventaire australien des substances chimiques (AICS)	Oui
Canada	Liste intérieure des substances (LIS)	Oui
Canada	Liste extérieure des substances (LES)	Non
Chine	Inventaire des substances chimiques existantes en Chine (IECSC)	Oui
Europe	Inventaire européen des substances chimiques commerciales existantes (EINECS)	Non
Europe	Liste européenne des substances chimiques notifiées (ELINCS)	Non
Japon	Inventaire des substances chimiques existantes et nouvelles (ENCS)	Oui
Corée	Liste des produits chimiques existants (ECL)	Oui
Nouvelle-Zélande	Inventaire de la Nouvelle-Zélande	Oui
Philippines	Inventaire philippin des produits et substances chimiques (PICCS)	Oui
États-Unis et Porto Rico	Inventaire du TSCA (Toxic Substances Controls Act - Loi réglementant les substances toxiques)	Oui

*La réponse « Oui » indique que tous les composants du produit sont conformes aux exigences d'entreposage du pays ayant compétence. Un « Non » indique qu'un ou plusieurs composant(s) du produit n'est/ne sont pas inscrit(s) ou exempt(s) d'une inscription sur l'inventaire administré par le(s) pays ayant compétence.

16. Autres informations

Date de publication 20-Avril-2017

Version n° 01

Avis de non-responsabilité Veolia Water Solutions & Technologies ne peut prévoir toutes les conditions d'utilisation des présents renseignements et de son produit, ou des produits d'autres fabricants en association avec son produit. L'utilisateur est responsable d'assurer des conditions sécuritaires de manutention, d'entreposage et d'élimination du produit, et il assume toute responsabilité quant à des pertes, des blessures, des dommages ou des dépenses liés à une utilisation incorrecte ou au non-respect des exigences de Veolia Solutions & Technologies.

**Informations relatives à la
révision**

Identification du produit et de l'entreprise : Identification du produit et de l'entreprise
Identification des dangers : Danger aux États-Unis
Composition / renseignements sur les ingrédients : Ingrédients
Données toxicologiques : Données toxicologiques
Données réglementaires: États-Unis
GHS: Classification

Solids conditioning for dewatering operations and water clarification aid in various industries

Description and Use

HYDREX 3613 is a highly effective cationic flocculant of high molecular weight.

HYDREX 3613 conditions solids for dewatering operations and aids water clarification processes in various industries.

HYDREX 3613 shows exceptional performance in liquid-solid separations in a wide range of shear conditions.

HYDREX 3613 may be beneficial in any liquid-solid separation process. It is especially recommended for:

- Belt filter, centrifuge and screw press dewatering
- Dissolved air floatation
- Filtration
- Thickening
- Water clarification

Advantages

- Dry product minimizes storage requirements
- Economical to use – effective at low dosage levels
- Effective high solids removal
- Effective over a wide pH range; does not alter the system pH
- Improves production and cake solids

Application Information

Stock solutions can be prepared up to 0.5 % concentration via an automated make down unit or on a batch basis. Solutions should be aged 30-60 minutes for maximum effectiveness. High quality make up water should be used. Secondary dilution water should be added to the stock solution prior to the addition point at a ratio of at least 10:1.

Centrifugal pumps should be avoided for polymer transfer.

More information on the back

Solids conditioning for dewatering operations and water clarification aid in various industries

Specifications

Appearance:	Off White, granular powder
Degree of Charge :	Low
Relative Molecular Weight:	High
Bulk Density, kg/m ³ :	750 +/- 50
pH of 0.5 % solution, at 25°C:	3.0 - 5.0
Standard Viscosity, cps :	3.0 - 3.8
Viscosity at 25°C, Cps:	
0.10 %:	80
0.25 %:	200
0.50 %:	400
1.00 %:	800

Product Sales Specification:

Insolubles, % w/w :	0.5 max
Residual Acrylamide, %:	0.020 max

The shelf life of HYDREX 3613 is 24 months when stored in unopened packages in a dry atmosphere at temperatures no higher than 40°C.

Materials Compatibility

Solutions are no more corrosive than water and recommended materials of construction include stainless steel, fiber glass, plastic, and glass or epoxy-lined vessels. Do not use iron, copper or aluminium.

Packaging

Supplied in bags. Other packaging : please consult us.

Safety Information

Spilled polymer is very slippery and should be collected prior to flushing with water. Whoever is responsible for the use and the manipulation of HYDREX 3613 should be familiar with the safety detailed in our MSDS.

Regulatory Approvals : see MSDS

Conditionnement de solides pour la déshydratation et les opérations de clarification de l'eau

Applications

HYDREX 3613 est un flocculant cationique très efficace, de haut poids moléculaire.

HYDREX 3613 montre des performances exceptionnelles en séparation solide/liquide sur un large éventail de conditions.

HYDREX 3613 est bénéfique à tout processus de séparation solide liquide-. Il est particulièrement recommandé pour:

- Les deshydratation surfiltres à bande, centrifugeuses et filtres presses
- Les opérations de flottation à air dissous
- La filtration
- L'épaississement
- La clarification de l'eau.

Avantages

- Produit sec : minimise les besoins en stockage
- Économique à l'utilisation : efficace à faible doses
- Efficace, même sur effluents fortement chargés en solides
- Efficace sur une large gamme de pH : ne modifie pas le pH
- Améliore la production et la qualité des gâteaux de filtration.

Mise en oeuvre

HYDREX 3613 ne peut être utilisé tel quel. Il faut au préalable préparer une solution stock.
Utiliser pour ce faire une installation de dispersion et de maturation de la poudre prévue à cet effet.

Concentration maxi de la solution stock (g/l) : 5

Utiliser pour ce faire une eau de bonne qualité

Temps de maturation nécessaire : de 30-60 minutes

Une dilution secondaire est préférable avant le point d'injection à un ratio d'au moins 10:1.

Les Pompes centrifuges sont à proscrire pour le transfert des polymères

Conditionnement de solides pour la déshydratation et les opérations de clarification de l'eau

Spécifications

Aspect :	Blanc cassé, sous forme de poudre granuleuse
Degré de Charge:	Basse
Masse moléculaire relative:	Haute
Densité:	750+ / - 50
pH de solution à 0,5%, à 25°C:	3.0 - 5.0
Viscosité standard, Cps:	3.0-3.8
Viscosité à 25°C, Cps:	
@0,10%:	80
@0,25%:	200
@0,50%:	400
@1.00 %:	800

Spécifications de ventes du produit :

Insolubles, % w / w: 0.5 max

Acrylamide résiduel, %: 0,020 max.

HYDREX 3613 se conserve jusqu'à 24 mois dans son emballage d'origine non entamé, au sec et à une température ne dépassant pas 40°C.

Compatibilité Matériels

Les solutions ne sont plus corrosives que l'eau. Les matériaux recommandés sont : l'acier inoxydable, la fibre de verre, le plastique et de verre ou matériaux enduits époxy ou fibre de verre.

Ne pas utiliser de fer, cuivre ou aluminium.

Conditionnement

Livraison par sacs. Pour toute autre demande d'emballage : veuillez nous consulter.

Sécurité

Le déversement de polymère rend les surfaces très glissantes.

La manipulation de tous produits chimiques demande de la précaution. Quiconque est responsable de l'utilisation et de la manipulation de l'hydrex 3613 devrait se familiariser avec les consignes de sécurité détaillées dans notre MSDS.

Agréments: voir la msds

1. Identification

Product identifier	VEOLIA ACTISAND
Other means of identification	None.
Recommended use	Wastewater Treatment
Recommended restrictions	Workers (and your customers or users in the case of resale) should be informed of the potential presence of respirable dust and respirable crystalline silica as well as their potential hazards. Appropriate training in the proper use and handling of this material should be provided as required under applicable regulations. PROFESSIONAL USE ONLY
Manufacturer/Importer/Supplier/Distributor information	
Manufacturer	
Supplier	Veolia Water Technologies Canada Inc.
Address	2000 Argentia Road, Plaza IV, Suite 430 Mississauga, ON L5N 1W1 Canada
Contact Person	Hydrex Product Specialist
Telephone	(905) 286-4846
Fax	(905) 286-0488
e-mail	vwtcanada-hydrex@veolia.com
24-Hour Emergency telephone	+1-760-476-3962 (Code:333239)
Supplier	Not available.

2. Hazard(s) identification

Physical hazards	Not classified.	
Health hazards	Carcinogenicity	Category 1A
Environmental hazards	Not classified.	
Label elements		



Signal word	Danger
Hazard statement	May cause cancer.
Precautionary statement	
Prevention	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves/protective clothing/eye protection/face protection.
Response	IF exposed or concerned: Get medical advice/attention.
Storage	Not available.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Other hazards	None known.
Supplemental information	None.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
Crystalline silica		14808-60-7	100

All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Skin contact	Wash off with soap and water. Get medical attention if irritation develops and persists.
Eye contact	Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. Get medical attention if symptoms occur.
Most important symptoms/effects, acute and delayed	Coughing.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.
General information	IF exposed or concerned: Get medical advice/attention. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO ₂).
Unsuitable extinguishing media	Not available.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Use water spray to cool unopened containers.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	The product is immiscible with water and will spread on the water surface. Stop the flow of material, if this is without risk. Following product recovery, flush area with water. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep formation of airborne dusts to a minimum. Provide appropriate exhaust ventilation at places where dust is formed. Do not breathe dust. Avoid prolonged exposure. Should be handled in closed systems, if possible. Wear appropriate personal protective equipment. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Protect from sunlight. Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS). Store in cool, dry place.

8. Exposure controls/personal protection

Occupational exposure limits

US. ACGIH Threshold Limit Values

Material	Type	Value	Form
VEOLIA ACTISAND	TWA	0.025 mg/m ³	Respirable fraction.
Components	Type	Value	Form
Crystalline silica (CAS 14808-60-7)	TWA	0.025 mg/m ³	Respirable fraction.

Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2)

Material	Type	Value	Form
VEOLIA ACTISAND Components	TWA Type	0.025 mg/m3 Value	Respirable particles. Form
Crystalline silica (CAS 14808-60-7)	TWA	0.025 mg/m3	Respirable particles.

Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended)

Material	Type	Value	Form
VEOLIA ACTISAND Components	TWA Type	0.025 mg/m3 Value	Respirable fraction. Form
Crystalline silica (CAS 14808-60-7)	TWA	0.025 mg/m3	Respirable fraction.

Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act)

Components	Type	Value	Form
Crystalline silica (CAS 14808-60-7)	TWA	0.025 mg/m3	Respirable fraction.

Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents)

Material	Type	Value	Form
VEOLIA ACTISAND Components	TWA Type	0.1 mg/m3 Value	Respirable. Form
Crystalline silica (CAS 14808-60-7)	TWA	0.1 mg/m3	Respirable.

Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment)

Material	Type	Value	Form
VEOLIA ACTISAND Components	TWA Type	0.1 mg/m3 Value	Respirable dust. Form
Crystalline silica (CAS 14808-60-7)	TWA	0.1 mg/m3	Respirable dust.

Biological limit values

No biological exposure limits noted for the ingredient(s).

Exposure guidelines

Occupational exposure to nuisance dust (total and respirable) and respirable crystalline silica should be monitored and controlled.

Appropriate engineering controls

Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin protection

Hand protection Chemical resistant gloves. Suitable gloves can be recommended by the glove supplier.

Other

Use of an impervious apron is recommended. Chemical resistant gloves.

Respiratory protection

Use a particulate filter respirator for particulate concentrations exceeding the Occupational Exposure Limit.

Thermal hazards

Not available.

General hygiene considerations

Observe any medical surveillance requirements. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties**Appearance**

Physical state	Solid.
Form	Solid.
Color	Not available.

Material name: VEOLIA ACTISAND

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SDS Canada

Odor	Not available.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	< 0.0000001 kPa at 25 °C
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Insoluble
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Explosive properties	Not explosive.
Heat of combustion (NFPA 30B)	0 kJ/g
Molecular formula	O2Si
Oxidizing properties	Not oxidizing.

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Powerful oxidizers. Chlorine.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Prolonged inhalation may be harmful.
Skin contact	No adverse effects due to skin contact are expected.
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	Expected to be a low ingestion hazard.

Symptoms related to the physical, chemical and toxicological characteristics	Coughing.
Information on toxicological effects	
Acute toxicity	Not available.
Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.
Respiratory or skin sensitization	
Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	In 1997, IARC (the International Agency for Research on Cancer) concluded that crystalline silica inhaled from occupational sources can cause lung cancer in humans. However in making the overall evaluation, IARC noted that "carcinogenicity was not detected in all industrial circumstances studied. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs." (IARC Monographs on the evaluation of the carcinogenic risks of chemicals to humans, Silica, silicates dust and organic fibres, 1997, Vol. 68, IARC, Lyon, France.) In June 2003, SCOEL (the EU Scientific Committee on Occupational Exposure Limits) concluded that the main effect in humans of the inhalation of respirable crystalline silica dust is silicosis. "There is sufficient information to conclude that the relative risk of lung cancer is increased in persons with silicosis (and, apparently, not in employees without silicosis exposed to silica dust in quarries and in the ceramic industry). Therefore, preventing the onset of silicosis will also reduce the cancer risk..." (SCOEL SUM Doc 94-final, June 2003) According to the current state of the art, worker protection against silicosis can be consistently assured by respecting the existing regulatory occupational exposure limits. May cause cancer. Occupational exposure to respirable dust and respirable crystalline silica should be monitored and controlled.
ACGIH Carcinogens	
Crystalline silica (CAS 14808-60-7)	A2 Suspected human carcinogen.
Canada - Alberta OELs: Carcinogen category	
Crystalline silica (CAS 14808-60-7)	Suspected human carcinogen.
Canada - Manitoba OELs: carcinogenicity	
SILICA, CRYSTALLINE-.ALPHA-.QUARTZ, RESPIRABLE FRACTION (CAS 14808-60-7)	Suspected human carcinogen.
Canada - Quebec OELs: Carcinogen category	
Crystalline silica (CAS 14808-60-7)	Suspected carcinogenic effect in humans.
IARC Monographs. Overall Evaluation of Carcinogenicity	
Crystalline silica (CAS 14808-60-7)	1 Carcinogenic to humans.
Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	Not an aspiration hazard.
Chronic effects	Prolonged inhalation may be harmful. Prolonged exposure may cause chronic effects.

12. Ecological information

Ecotoxicity	The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.
Persistence and degradability	No data is available on the degradability of this product.
Bioaccumulative potential	No data available.
Mobility in soil	No data available.
Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of contents/container in accordance with local/regional/national/international regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

TDG

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable.

15. Regulatory information

Canadian regulations

Controlled Drugs and Substances Act

Not regulated.

Export Control List (CEPA 1999, Schedule 3)

Not listed.

Greenhouse Gases

Not listed.

Precursor Control Regulations

Not regulated.

International regulations

Stockholm Convention

Not applicable.

Rotterdam Convention

Not applicable.

Kyoto protocol

Not applicable.

Montreal Protocol

Not applicable.

Basel Convention

Not applicable.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No

Country(s) or region	Inventory name	On inventory (yes/no)*
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other Information

Issue date	08-16-2016
Version #	01
Disclaimer	Veolia Water Technologies is not able to anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use and or non respect of Veolia Water Technologies' requirement.
Revision information	Product and Company Identification: Product Review

1. Identification

Identificateur de produit	VEOLIA ACTISAND
Autres moyens d'identification	Aucune.
Usage recommandé	Traitement des eaux usées
Restrictions d'utilisation	Les travailleurs (et vos clients et utilisateurs dans le cas d'une revente) doivent être informés de la présence possible de poussière respirable et de silice cristalline respirable ainsi que de leurs dangers possibles. Une formation appropriée dans la bonne utilisation et la bonne manipulation de cette matière doit être fournie selon la réglementation applicable. USAGE PROFESSIONNEL
Renseignements sur le fabricant/importateur/fournisseur/distributeur	
Fabricant	
Fournisseur	Veolia Water Technologies Canada Inc.
Adresse	2000 Argentia Road, Plaza IV, Suite 430 Mississauga, ON L5N 1W1 Canada
Personne à contacter	Hydrex Product Specialist
Téléphone	(905) 286-4846
Télécopieur	(905) 286-0488
courriel	vwtcanada-hydrex@veolia.com
24 Hr Numéro de téléphone d'appel d'urgence	+1-760-476-3962 (Code:333239)
Fournisseur	Non disponible.

2. Identification des dangers

Dangers physiques	Non classé.	
Dangers pour la santé	Cancérogénicité	Catégorie 1A
Dangers environnementaux	Non classé.	

Éléments d'étiquetage



Mention d'avertissement	Danger
Mention de danger	Peut provoquer le cancer.
Conseil de prudence	
Prévention	Se procurer les instructions avant utilisation. Ne pas manipuler avant d'avoir lu et compris toutes les mesures de sécurité. Porter des gants/vêtements de protection/ équipement de protection des yeux/du visage.
Intervention	Si exposé(e) ou préoccupé(e) : Obtenir une consultation médicale ou des soins médicaux.
Stockage	Non disponible.
Élimination	Éliminer le contenu/les conteneurs selon la loi internationale/nationale/régionale/locale.
Autres dangers	Aucuns connus.
Renseignements supplémentaires	Aucune.

3. Composition/information sur les ingrédients

Mélanges

Nom de la matière : VEOLIA ACTISAND
 2725 Version n°: 01 Date de publication: 16-Août-2016
 SDS Canada

Dénomination chimique	Nom commun et synonymes	Numéro d'enregistrement CAS	%
Crystalline silica		14808-60-7	100

Toutes les concentrations sont en pourcentage en poids, sauf si l'ingrédient est un gaz. Les concentrations des gaz sont en pourcentage en volume.

4. Premiers soins

Inhalation	Sortir au grand air. Appeler un médecin si les symptômes se développent ou s'ils persistent.
Contact avec la peau	Laver avec de l'eau et du savon. Consulter un médecin si une irritation se développe et persiste.
Contact avec les yeux	Rincer avec de l'eau. Consulter un médecin si une irritation se développe et persiste.
Ingestion	Rincer la bouche. Faire appel à une assistance médicale si des symptômes apparaissent.
Symptômes et effets les plus importants, qu'ils soient aigus ou retardés	Toux.
Mention de la nécessité d'une prise en charge médicale immédiate ou d'un traitement spécial, si nécessaire	Donner des soins généraux et traiter en fonction des symptômes. Garder la victime en observation. Les symptômes peuvent se manifester à retardement.
Informations générales	Si exposé(e) ou préoccupé(e) : Obtenir une consultation médicale ou des soins médicaux. S'assurer que le personnel médical est averti des substances impliquées et prend les précautions pour se protéger.

5. Mesures à prendre en cas d'incendie

Agents extincteurs appropriés	Brouillard d'eau. Mousse. Poudre chimique sèche. Dioxyde de carbone (CO2).
Agents extincteurs inappropriés	Non disponible.
Dangers spécifiques du produit dangereux	Des gaz dangereux pour la santé peuvent se former pendant l'incendie.
Équipements de protection spéciaux et précautions spéciales pour les pompiers	Porter un appareil respiratoire autonome et un vêtement de protection complet en cas d'incendie.
Équipement/directives de lutte contre les incendies	Les récipients fermés peuvent être refroidis par eau pulvérisée.
Méthodes particulières d'intervention	Employer des méthodes normales de lutte contre l'incendie et tenir compte des dangers associés aux autres substances présentes.
Risques d'incendie généraux	Aucun risque exceptionnel d'incendie et d'explosion.

6. Mesures à prendre en cas de déversement accidentel

Précautions individuelles, équipements de protection et mesures d'urgence	Tenir à l'écart le personnel dont la présence sur les lieux n'est pas indispensable. Garder les personnes à l'écart de l'endroit du déversement/de la fuite et en amont du vent. Porter un équipement et des vêtements de protection appropriés durant le nettoyage. S'assurer une ventilation adéquate. Prévenir les autorités locales si des fuites significatives ne peuvent pas être contenues. Pour s'informer sur la protection individuelle, voir la rubrique 8.
Méthodes et matériaux pour le confinement et le nettoyage	Le produit n'est pas miscible avec l'eau et se dispersera sur la surface de l'eau. Arrêter l'écoulement de la substance, si cela peut se faire sans risque. Après avoir récupéré le produit, rincer la zone à l'eau. Pour se renseigner sur l'élimination, voir la rubrique 13.
Précautions relatives à l'environnement	Éviter le rejet dans les égouts, les cours d'eau ou sur le sol.

7. Manutention et stockage

Précautions relatives à la sûreté en matière de manutention	Se procurer les instructions avant utilisation. Ne pas manipuler avant d'avoir lu et compris toutes les mesures de sécurité. Minimiser la formation de poussières en suspension dans l'air. Fournir une ventilation aspirante adéquate aux endroits où la poussière se forme. Ne pas respirer les poussières. Éviter l'exposition prolongée. Si possible, manipuler dans un système clos. Porter un équipement de protection individuelle approprié. Observer de bonnes pratiques d'hygiène industrielle.
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8. Contrôle de l'exposition/protection individuelle

Limites d'exposition professionnelle

ÉTATS-UNIS. Valeurs limites d'exposition de l'ACGIH

Substance	Type	Valeur	Forme
VEOLIA ACTISAND	TWA	0.025 mg/m3	Fraction respirable.
Composants	Type	Valeur	Forme

Crystalline silica (CAS 14808-60-7)	TWA	0.025 mg/m3	Fraction respirable.
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Canada. LEMT pour l'Alberta (Code de l'hygiène et de la sécurité au travail, Annexe 1, Tableau 2)

Substance	Type	Valeur	Forme
VEOLIA ACTISAND	TWA	0.025 mg/m3	Particules inhalables.
Composants	Type	Valeur	Forme

Crystalline silica (CAS 14808-60-7)	TWA	0.025 mg/m3	Particules inhalables.
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Canada. LEMT pour la Colombie-Britannique. (Valeurs limites d'exposition en milieu de travail pour les substances chimiques, Réglementation sur la santé et sécurité au travail 296/97, ainsi modifiée)

Substance	Type	Valeur	Forme
VEOLIA ACTISAND	TWA	0.025 mg/m3	Fraction respirable.
Composants	Type	Valeur	Forme

Crystalline silica (CAS 14808-60-7)	TWA	0.025 mg/m3	Fraction respirable.
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Canada. LEMT de Manitoba (Règlement 217/2006, Loi sur la sécurité et l'hygiène du travail)

Composants	Type	Valeur	Forme
Crystalline silica (CAS 14808-60-7)	TWA	0.025 mg/m3	Fraction respirable.

Canada. LEMT pour l'Ontario. (Contrôle de l'exposition à des agents biologiques et chimiques)

Substance	Type	Valeur	Forme
VEOLIA ACTISAND	TWA	0.1 mg/m3	Respirable.
Composants	Type	Valeur	Forme

Crystalline silica (CAS 14808-60-7)	TWA	0.1 mg/m3	Respirable.
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Canada. LEMT du Québec, (Ministère du Travail. Règlement sur la qualité du milieu de travail)

Substance	Type	Valeur	Forme
VEOLIA ACTISAND	TWA	0.1 mg/m3	Poussière respirable.
Composants	Type	Valeur	Forme

Crystalline silica (CAS 14808-60-7)	TWA	0.1 mg/m3	Poussière respirable.
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Valeurs biologiques limites

Aucune limite d'exposition biologique observée pour les ingrédients.

Directives au sujet de l'exposition

Une exposition professionnelle à de la poussière nuisible (totale et respirable) et à de la silice cristalline respirable doit être suivie et contrôlée.

Contrôles d'ingénierie appropriés

Il faut utiliser une bonne ventilation générale (habituellement dix changements d'air l'heure). Les débits de ventilation doivent être adaptés aux conditions. S'il y a lieu, utiliser des enceintes d'isolement, une ventilation locale ou d'autres mesures d'ingénierie pour maintenir les concentrations atmosphériques sous les limites d'exposition recommandées. Si des limites d'exposition n'ont pas été établies, maintenir les concentrations atmosphériques à un niveau acceptable.

Mesures de protection individuelle, telles que les équipements de protection individuelle

Protection du visage/des yeux

Porter des lunettes de sécurité à écrans latéraux (ou des lunettes à coques).

Protection de la peau	
Protection des mains	Gants résistants aux produits chimiques. Les gants appropriés peuvent être indiqués par le fournisseur de gants.
Autre	L'emploi d'un tablier imperméable est recommandé. Gants résistants aux produits chimiques.
Protection respiratoire	Utiliser un respirateur avec filtre particulaire lorsque les concentrations particulières sont supérieures à la limite d'exposition professionnelle.
Dangers thermiques	Non disponible.
Considérations d'hygiène générale	Suivre toutes les exigences de surveillance médicale. Toujours adopter de bonnes pratiques d'hygiène personnelle, telles que se laver après avoir manipulé la substance et avant de manger, de boire ou de fumer. Nettoyer régulièrement la tenue de travail et l'équipement de protection pour éliminer les contaminants.

9. Propriétés physiques et chimiques

Apparence	
État physique	Solide.
Forme	Solide.
Couleur	Non disponible.
Odeur	Non disponible.
Seuil olfactif	Non disponible.
pH	Non disponible.
Point de fusion et point de congélation	Non disponible.
Point initial d'ébullition et domaine d'ébullition	Non disponible.
Point d'éclair	Non disponible.
Taux d'évaporation	Non disponible.
Inflammabilité (solides et gaz)	Non disponible.
Limites supérieures et inférieures d'inflammabilité ou d'explosibilité	
Limites d'inflammabilité - inférieure (%)	Non disponible.
Limites d'inflammabilité - supérieure (%)	Non disponible.
Limite d'explosibilité - inférieure (%)	Non disponible.
Limite d'explosibilité - supérieure (%)	Non disponible.
Tension de vapeur	< 0.0000001 kPa à 25 °C
Densité de vapeur	Non disponible.
Densité relative	Non disponible.
Solubilité	
Solubilité (eau)	Insoluble
Coefficient de partage n-octanol/eau	Non disponible.
Température d'auto-inflammation	Non disponible.
Température de décomposition	Non disponible.
Viscosité	Non disponible.
Autres informations	
Propriétés explosives	Non explosif.

Chaleur de combustion (NFPA 30B)	0 kJ/g
Formule moléculaire	O ₂ Si
Propriétés comburantes	Non oxydant.

10. Stabilité et réactivité

Réactivité	Le produit est stable et non réactif dans des conditions normales d'utilisation, d'entreposage et de transport.
Stabilité chimique	La substance est stable dans des conditions normales.
Risque de réactions dangereuses	Pas de réactions dangereuses connues dans les conditions normales d'utilisation.
Conditions à éviter	Contact avec des matériaux incompatibles.
Matériaux incompatibles	Oxydants puissants. Chlore
Produits de décomposition dangereux	Aucun produit dangereux de décomposition n'est connu.

11. Données toxicologiques

Renseignements sur les voies d'exposition probables

Inhalation	Toute inhalation prolongée peut être nocive.
Contact avec la peau	Aucun effet indésirable par contact avec la peau n'est attendu.
Contact avec les yeux	Le contact direct avec les yeux peut causer une irritation temporaire.
Ingestion	Faible danger présumé en cas d'ingestion.

Les symptômes correspondant aux caractéristiques physiques, chimiques et toxicologiques

Toux.

Renseignements sur les effets toxicologiques

Toxicité aiguë	Non disponible.
Corrosion cutanée/irritation cutanée	Un contact prolongé avec la peau peut entraîner une irritation temporaire.
Lésions oculaires graves/irritation oculaire	Le contact direct avec les yeux peut causer une irritation temporaire.

Sensibilisation respiratoire ou cutanée

Sensibilisation respiratoire	N'est pas un sensibilisant respiratoire.
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Sensibilisation cutanée	Ce produit ne devrait pas causer une sensibilisation de la peau.
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Mutagenicité sur les cellules germinales

Il n'existe pas de données indiquant que ce produit, ou tout composant présent à des taux de plus de 0,1 %, soit mutagène ou génétoxique.

Cancérogénicité

En 1997, le CIRC (Centre international de recherche sur le cancer) a conclu que la silice cristalline inhalée de sources professionnelles pouvait provoquer un cancer du poumon chez l'homme. Toutefois, lors de son évaluation globale, le CIRC a observé que « le pouvoir cancérogène n'était pas détecté dans toutes les conditions industrielles examinées. Le pouvoir cancérogène peut dépendre de caractéristiques intrinsèques de la silice cristalline ou de facteurs externes qui touchent son activité biologique ou la distribution de ses polymorphes. » (Monographies du CIRC sur l'évaluation des risques cancérogènes de substances chimiques pour l'être humain, Silice, poussière de silicates et fibres organiques, 1997, vol. 68, CIRC, Lyon, France.) En juin 2003, le CSLEP (Comité scientifique en matière de limites d'exposition professionnelle à des agents chimiques) a conclu que le principal effet chez l'être humain de l'inhalation de la poussière de silice cristalline respirable est la silicose. « Les données disponibles sont suffisantes pour conclure que le risque de cancer du poumon est accru chez les personnes atteintes de silicose (et non, semble-t-il, chez les employés exempts de silicose exposés à la poussière de silice dans les carrières et dans le secteur industriel des céramiques). Dès lors, la prévention de l'apparition de la silicose réduira également le risque de cancer... » (SCOEL SUM Doc 94-final, juin 2003) Selon l'état de la technique actuel, la protection des travailleurs contre la silicose peut être assurée de manière systématique en respectant les limites d'exposition professionnelle réglementaires existantes. Peut provoquer le cancer. Une exposition professionnelle à de la poussière respirable et à de la silice cristalline respirable doit être suivie et contrôlée.

Carcinogènes selon l'ACGIH

Crystalline silica (CAS 14808-60-7)

A2 Probablement cancérogène pour l'homme.

Canada - LEMT pour l'Alberta : Catégorie de carcinogène

Crystalline silica (CAS 14808-60-7)

Probablement cancérogène pour l'homme.

Canada - LEMT pour le Manitoba : cancérogénicité

SILICE, CRISTALLINE-.ALPHA.-QUARTZ, FRACTION
RESPIRABLE (CAS 14808-60-7)

Probablement cancérogène pour l'homme.

Canada - LEMT pour le Québec : Catégorie de carcinogène

Crystalline silica (CAS 14808-60-7)

Effet cancérogène suspecté chez les humains.

Monographies du CIRC. Évaluation globale de la cancérogénicité

Crystalline silica (CAS 14808-60-7)

1 Cancérogène pour l'homme.

Toxicité pour la reproduction	On ne s'attend pas à ce que ce produit présente des effets sur la reproduction ou le développement.
Toxicité pour certains organes cibles - exposition unique	Non classé.
Toxicité pour certains organes cibles - expositions répétées	Non classé.
Danger par aspiration	N'est pas un danger d'aspiration.
Effets chroniques	Toute inhalation prolongée peut être nocive. Une exposition prolongée peut causer des effets chroniques.

12. Données écologiques

Écotoxicité	Le produit n'est pas classé comme dangereux pour l'environnement. Toutefois, ceci n'exclut pas la possibilité que des déversements importants ou fréquents puissent avoir un effet nocif ou nuisible sur l'environnement.
Persistance et dégradation	Aucune donnée n'est disponible sur la biodégradabilité du produit.
Potentiel de bioaccumulation	Aucune donnée disponible.
Mobilité dans le sol	Aucune donnée disponible.
Autres effets nocifs	On ne prévoit aucun autre effet environnemental négatif (par ex., appauvrissement de la couche d'ozone, potentiel de formation photochimique d'ozone, perturbation endocrinienne, potentiel de réchauffement de la planète) causé par ce composant.

13. Données sur l'élimination

Instructions pour l'élimination	Recueillir et réutiliser ou éliminer dans des récipients scellés dans un site d'élimination des déchets autorisé. Éliminer le contenu/les conteneurs selon la loi internationale/nationale/régionale/locale.
Règlements locaux d'élimination	Détruire conformément à toutes les réglementations applicables.
Code des déchets dangereux	Les codes de déchets doivent être attribués dans le cadre d'une consultation entre l'utilisateur, le fabricant et l'entreprise de décharge.
Déchets des résidus / produits non utilisés	Éliminer le produit conformément avec la réglementation locale en vigueur. Des résidus de produit peuvent demeurer dans les contenants vides et sur les toiles d'emballage. Ce produit et son contenant doivent être éliminés de façon sécuritaire (voir les instructions d'élimination).
Emballages contaminés	Comme les récipients vides peuvent contenir des résidus de produit, respecter les avertissements sur l'étiquette même après avoir vidé le récipient. Les contenants vides doivent être acheminés vers une installation certifiée de traitement des déchets en vue de leur élimination ou recyclage.

14. Informations relatives au transport

TMD	N'entre pas dans la réglementation des marchandises dangereuses.
IATA	N'entre pas dans la réglementation des marchandises dangereuses.
IMDG	N'entre pas dans la réglementation des marchandises dangereuses.

15. Informations sur la réglementation

Réglementation canadienne

Loi réglementant certaines drogues et autres substances

Non réglementé.

Liste des marchandises d'exportation contrôlée (LCPE 1999, Annexe 3)

Non inscrit.

Gaz à effet de serre

Non inscrit.

Règlements sur les précurseurs

Non réglementé.

Règlements internationaux

Convention de Stockholm

Sans objet.

Convention de Rotterdam

Sans objet.

Protocole de Kyoto

Sans objet.

Montreal Protocol

Sans objet.

Convention de Bâle

Sans objet.

Inventaires Internationaux

Pays ou région	Nom de l'inventaire	En stock (Oui/Non)*
Australie	Inventaire australien des substances chimiques (AICS)	Oui
Canada	Liste intérieure des substances (LIS)	Oui
Canada	Liste extérieure des substances (LES)	Non
Chine	Inventaire des substances chimiques existantes en Chine (IECSC)	Oui
Europe	Inventaire européen des substances chimiques commerciales existantes (EINECS)	Oui
Europe	Liste européenne des substances chimiques notifiées (ELINCS)	Non
Japon	Inventaire des substances chimiques existantes et nouvelles (ENCS)	Oui
Corée	Liste des produits chimiques existants (ECL)	Oui
Nouvelle-Zélande	Inventaire de la Nouvelle-Zélande	Oui
Philippines	Inventaire philippin des produits et substances chimiques (PICCS)	Oui
États-Unis et Porto Rico	Inventaire du TSCA (Toxic Substances Controls Act - Loi réglementant les substances toxiques)	Oui

*La réponse « Oui » indique que tous les composants du produit sont conformes aux exigences d'entreposage du pays ayant compétence
Un « Non » indique qu'un ou plusieurs composant(s) du produit n'est/ne sont pas inscrit(s) ou exempt(s) d'une inscription sur l'inventaire administré par le(s) pays ayant compétence.

16. Renseignements divers

Date de publication	16-Août-2016
Version n°	01
Avis de non-responsabilité	Veolia Water Solutions & Technologies ne peut prévoir toutes les conditions d'utilisation des présents renseignements et de son produit, ou des produits d'autres fabricants en association avec son produit. L'utilisateur est responsable d'assurer des conditions sécuritaires de manutention, d'entreposage et d'élimination du produit, et il assume toute responsabilité quant à des pertes, des blessures, des dommages ou des dépenses liés à une utilisation incorrecte ou au non-respect des exigences de Veolia Solutions & Technologies.

FIELD INSTALLATION / PAINT PROTECTION

IMPORTANT NOTE TO MECHANICAL CONTRACTORS

You are about to install **ACTIFLO®** or **DUSENFLO®** Package Plant units and their related skids and equipment. **John Meunier Inc.** wants to warn you about potential problems related to installation of large steel units protected against corrosion by paint.

John Meunier Inc. maintains a comprehensive quality program to prevent equipment from being affected by corrosion. Our fabrication methods are specially adapted to manufacturing of painted equipment. Every step of our fabrication and assembly process is checked to reduce corrosion issues. Each unit is also delivered under strict measures, meant to reduce potential corrosion problems and long product life.

However, we have identified that handling unit at job site is a key element of corrosion protection process. This operation completely escapes our control and is your responsibility. Consequently, we invite you to perform a thorough review of your installation procedures before handling John Meunier products. Protecting units during and after installation is paramount to maintain corrosion risks to a bare minimum.

Likewise, after installation of units, you must insure complete equipment protection from working environment before unit is put into service. This will prevent damages caused by work not related to John Meunier products taking place on site. Contractor is responsible for installation of any additional protection necessary at job site.

In order to maintain quality products free of defects, **John Meunier Inc.** requests from Contractor, that he takes all necessary measures to reduce risks of paint or equipment damage leading to steel corrosion. Among most important protection measures of paint protection, here are the principal ones:

- Making all men, working close to units, conscious of paint fragility and potential corrosion problems. Please encourage them to act with extreme care while working around installation.
- Protecting units from weld projection or falling debris, by covering unit with adequate plastic or cardboard hoods and padding.
- Protecting unit's tank bottom when installing mixers or other equipment inside unit.
- Keeping area and unit clean at all times.

All measures taken by contractor to insure paint protection will assure transfer to client of a quality product and will benefit to all.

Thanks for your help and understanding

John Meunier Inc.

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IMPORTANT NOTICE CONCERNING MODIFICATIONS DONE BY THE CLIENT

Please note that it is mandatory to contact John Meunier Inc. before undertaking any modification work to the equipment supplied in this project. In fact, any alteration made to any equipment (mechanical, control, computers, etc.) without prior notification and consent by John Meunier Inc. voids the warranty of the mentioned equipment. Furthermore, the client is responsible for any additional cost necessary to restore the equipment to its original state.

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WARRANTY

All equipment manufactured by **JOHN MEUNIER INC.** is guaranteed to be free from defects in material and workmanship for a period of twelve (12) months from the date at which unit is placed in service, eighteen (18) months from the date of shipment, whichever occurs first. All equipment found with defects during this period will be replaced at no extra charge when shipped prepaid FOB to the manufacturer's shop. All parts sold by **JOHN MEUNIER INC.** are warranted the same way for a period of three (3) months from date of shipment.

If the customer promptly notifies **JOHN MEUNIER INC.** in writing of a claimed defect in the equipment and said equipment is found not to be in conformity with this warranty, **JOHN MEUNIER INC.** will, at its option and expenses, repair or replace such defective part, prepaid FOB to the manufacturer's shop.

JOHN MEUNIER INC. must be given notice of such defect, and, where requested, such material must be returned to the manufacturer's shop, transportation charges prepaid, with written approval for the shipment by **JOHN MEUNIER INC.**

This warranty shall be void if start-up of equipment is not authorized by **JOHN MEUNIER INC.**, or if repairs and/or alterations are made without a written authorization by **JOHN MEUNIER INC.** If the equipment or parts supplied by **JOHN MEUNIER INC.** are altered in any way without **JOHN MEUNIER INC.** consent, the present warranty will not be valid and have no effect.

The customer will use only **JOHN MEUNIER INC.** parts for all labour covered by this warranty.

The foregoing warranty excludes responsibility or liability for :

- (a) Failures not reported promptly within the warranty period , above specified.
- (b) Damage due to accident, abuse, shipment, improper installation or operation, or abnormal operation condition.
- (c) Damage caused by client's replacement, repair or inspection of parts.
- (d) Lesion or personal accidents, material damage or any direct or indirect expenses or loss of profit related to this warranty.
- (e) Damage, loss, expenses, lesion or personal accidents directly or indirectly related to the installation, the operation or the failure of the equipment supplied by **JOHN MEUNIER INC.**

The foregoing warranty is exclusive and replaces all other warranties, expressed or implied, including but not limited to any warranty of bargaining or modification for a particular purpose.

This warranty does not cover the following :

- (a) Costs of repair, modification or other work done or requested by the customer or the management and all indirect costs.
- (b) All expenses related to regular maintenance of parts as prescribed in the operation and maintenance manuals supplied by **JOHN MEUNIER INC.**
- (c) Costs of dismantling, installation, transportation and insurance.
- (d) Travelling and living expenses for the personnel carrying out the repair under such warranty.
- (e) This warranty is not a performance or production warranty.

JOHN MEUNIER INC. has the right to examine or to ask for details about defects before empowering the present warranty.

Installation Manual

ACP-700R Actiflo® Package Plant

Project :
MEADOWBANK MINING CORP, NWT

Reference number:
NC01

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APPENDICES

DRAWING N°	DESCRIPTION
RC01 - FI100	ACTIFLO ACP-700R / FIELD INSTALLATION
RC01 - FI101	ACTIFLO ACP-700R / Ph PROBE INSTALLATION
RC01 - FI102	ACTIFLO ACP-700R / MIXERS INSTALLATION
ELECTRICAL	ELECTRICAL DRAWINGS IN REFERENCE WITH FIELD CONNECTION

1 RECEIVING

Preliminary field-testing, inspection, and checkout of the unit, following installation, shall be performed by a qualified representative of both the Supplier and the General Contractor. Tests shall be conducted to demonstrate to the Engineer that all system components furnished by the equipment supplier are fully operational, that all connecting piping is leak proof and properly anchored, and that the entire system furnished by the Supplier is ready for continuous and safe operation. The purpose of the checkout shall be to ensure that each individual system component has been correctly installed, shall operate fully in the manner intended, and is ready to perform its function as part of an integrated system when placed in continuous operation.

2 GENERAL INSTALLATION

The ACTIFLO® Package Plant is pre-mounted. However, for freight purpose and practical reasons, the installation of some items needs to be completed on site by the contractor. Please find below the list of tasks that need to be performed by the contractor at job site:

- Installation should be performed by qualified contractors.
- The contractor must ensure that the necessary lifting and handling equipment is available on site to carry out the installation.
- All nuts & bolts need to be verified and accounted for.

WARNING: *Settling tubes are shipped pre-installed in the settling tank zone of each Actiflo® package unit. These settling tubes are very flammable. Do not use any open flames near them and do not allow any welding work in the nearby area unless safety precautions have been taken. Once the settling tubes are in water (normal use), this warning is no longer applicable.*

- Refer to all field installation drawings for the installation of each Actiflo® unit.
- If any paint touch-ups are required, refer to Steel Tanks Technical Sheet ST-103 for Recommended Paint Preparation and Application Instructions.
- After installation is completed, clean and rid the tanks section of all debris & objects

that could damage the rotating mechanisms or clog the recirculation line.

- Microsand is supplied in 50-lbs bags in quantities required for first fill. Sand will be added to the injection tank during process start up.

2.1 ACTIFLO® UNITS LOCATION

- Install each unit at the designated location at site. Lifting lugs (4) are provided on top of each unit to facilitate handling and shall be removed after proper installation of the Actiflo unit in order to install the handrails.

WARNING: Do not use the side welded lugs on the Actiflo® package plant to lift the unit. These are for transportation purpose only.

2.1.1 Leveling

- Unit base frame must be perfectly leveled within proper tolerance.

2.1.2 Anchoring to concrete floor

- Refer to field installation drawing for tank anchors location.
- Drill appropriate holes in concrete support piers and align with the anchoring holes of the Actiflo® base and fasten the tank structure with anchors (supplied by others).

2.1.3 Unwrapping

- Unwrap the equipment and remove any temporary supports and plywood protections from the unit. Be cautious when unwrapping instrumentation protection.
- Add leveling/finishing grout under the base frame where required.

3 ACTIFLO® UNITS MECHANICAL INSTALLATION

3.1 Grating

- Grating is already installed on each unit.

3.2 Handrail

- Install hand railing on each unit at the site. Please refer to the field installation drawings.

3.3 Settling section

- Lamella packs are already installed in settling section.
- If required, be very cautious when manipulating the lamella packs in cold temperatures. They become very brittle and may break easily.

WARNING : *Lamella pack is highly flammable. Submerge with water as soon as possible.*

3.4 Trough

- The troughs already installed in the settling section should be leveled using the adjustment nuts. All troughs must be at the same elevation.

3.5 Scraper drive installation

- Remove the transportation plate from the rake assembly;
- Lower the shaft of the rake using the eyebolt;
- Replace the transportation plate by the rake drive;
- Connect the rake drive to the shaft;
- Remove the eyebolt from the rake shaft;
- Add the lubricant in the planetary gear housing. Use Chevron lubricating oils FM Grade ISO 460 or equivalent FDA approved. Please be careful about the amount of oil that is put in the scraper drive assembly as too much oil may overflow into the tank. The oil level should correspond to about ½ of the height of the gear;
- Rectify alignment if necessary;
- All electrical connections must be completed;
- Rotation of the rake must be C.W.;
- Ensure that there is no contact in between the rake arm and the bottom of the hopper;
- Clean the tanks section of all debris & objects that could damage the rotating

mechanisms.

- Inspect the recirculation inlet pipe. It should be free of any debris.

3.6 Hydrocyclone Support

- Refer to the field installation drawings for proper hydrocyclone installation.
- Install the hydrocyclone assembly support on the injection tank with supplied bolts, nuts and washers at the site.
- Install the piping connections.

3.7 Injection / Coagulation / Maturation Tank Mixer

- Refer to field installation drawings for proper mixers installation.
- The mixers are delivered separately. The shafts are already assembled to the gear box. The contractor must assemble the impellers on the shafts at job site.
- Install the motor on the appropriate tank mixer following instructions given in the supplier's Equipment Manual.
- Verify the mixer blade installation and orientation.
- Verify that set screws are well tightened to secure the hub onto the shaft.
- Follow manufacturer recommendations for oil check and fill up procedure (manual).

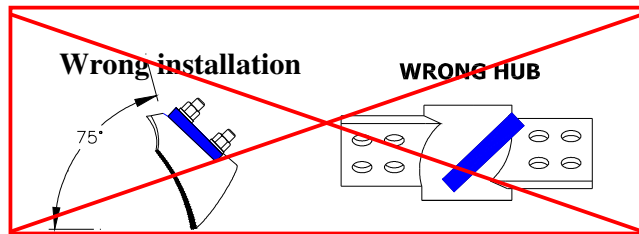
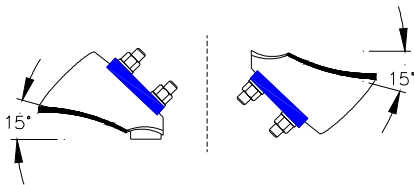
MIXERS

Standard Actiflo

WARNING :

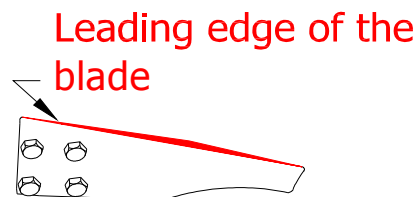
- ✓ Ensure the use of a **right hub** (\) in the three tanks.
- ✓ The leading edge of the blade shall be at 15° and not at 75°.
- ✓ The bolts and nuts must be installed on the wing but on the opposite side of the blade.

Two possible choices



LEGEND

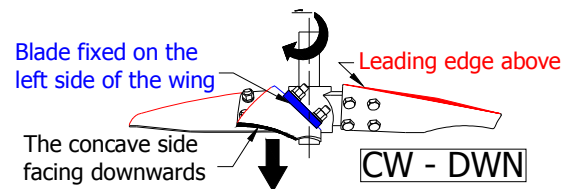
CW-UP : Clockwise – Up
CW-DWN : Clockwise – Down
CCW-UP : Counterclockwise – Up
CCW-DWN : Counterclockwise – Down



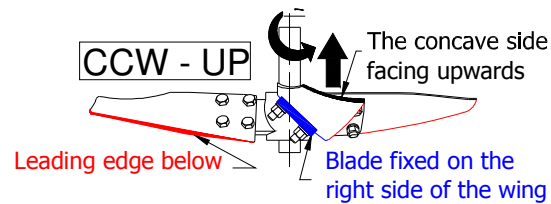
Possible mixer installation:

- Refer to the drawing FI102 for your particular application.

For coagulation and maturation:



For injection:



4 PERIPHERAL EQUIPMENT INSTALLATION

4.1 Microsand recirculation pump system

- Refer to field installation drawings for proper microsand recirculation pump system location and installation.
- Pump base frame must be leveled within proper tolerance.
- Drill appropriate holes in concrete floor and fasten the pump and flexible pipe supports with anchors.

4.2 Raw water turbidimeter

- Refer to field installation drawings for proper location.
- Pre-wired, pre-connected and pre-mounted on a support.
- The connection to the sample port is by others.

4.3 Coagulation pH meter

- Refer to field installation drawings for proper coagulation pH meter installation.
- Pre-wired, pre-connected and pre-mounted on a support.
- Install the coagulation pH meter with probe on handrail on the settling tank side with supplied bolts, nuts and washers.

4.4 Clarified water turbidimeter

- Pre-wired, pre-connected and pre-mounted on a support on the effluent side of the tanks.
- Refer to field installation drawings for proper clarified water turbidimeter installation.

5 PIPING CONNECTION

- Grease, protecting the flanges, must be removed prior to the installation of the valves & pipes.

Water collector: Pipe from the Actiflo® unit effluent flange to the clarified water collector.

Tanks drain:

- Pipe from the tank drain valves to the trench drain.

Settled water tank partial drain: Pipe from the pre-installed partial drain valve, located on Actiflo® effluent side, to the trench drain.

Clarified water turbidimeter:

- Pipe the clarified water turbidimeter located on Actiflo® unit effluent side, to an appropriate drain.
- Complete piping, if necessary, from the coupling located on the Actiflo® effluent side to the turbidimeter sampling inlet.

Important: Provide sufficient slope to ensure correct draining.
If connected to another drain line, ensure to prevent any backflow to the instrument.

Important: To avoid turbidimeter clogging, sample water piping must be connected prior to any coagulant or other viscous chemical product addition.

Hydrocyclone sludge outlet: Pipe from the hydrocyclone sludge outlet flange to the trench drain.

Important: Provide sufficient pipe slope and size to prevent any backflow to the hydrocyclone.

Recirculation pipe:

- Refer to field installation drawings for proper recirculation pipe installation.
- Verify the recirculation inlet pipe. It should be free of any debris.
- Connect the flexible pipe section using the quick coupling connections provided.
- Pipe-straps are supplied on the unit to secure the pipe along the tank wall.

Polymer feeding:

- Connect the supplied polymer injection tubing from the Actiflo® maturation and injection reservoirs to the appropriate hydrocyclone assembly support polymer distributor outlet.
- Supply polymer feeding pipe from the polymer metering pump skid outlet to the hydrocyclone assembly support polymer distributor inlet for the Actiflo® unit.

6 ELECTRICAL INSTALLATION

- Electrical work should be performed by a qualified contractor.
- Refer to Actiflo® Control Panel & Electrical diagram for proper wiring installation.

Control panel:

- Supply wiring between the Actiflo® unit junction box and the control panel.
- Supply power (460V/ 3 ph/ 60 Hz) to the Actiflo® control panel.
- Before permanently wiring the control panel, verify the rotation of each motor (Clockwise or Counter Clockwise).

Tank mixers:

- Rewire each mixer motor to junction box near each mixer.

WARNING: *Never run a mixer without the tank being completely filled with water.*

Scraper:

- Rewire scraper motor to junction box near scraper.

Raw water turbidimeter

- One (1) raw water turbidimeter is supplied pre-wired on influent side of Actiflo® #1.
- Recommended supplier's wiring instructions are given in the supplier's manual.

Clarified Water Turbidimeter:

- One (1) clarified water turbidimeter is supplied pre-wired on effluent side of each Actiflo®.
- Recommended supplier's wiring instructions are given in the supplier's manual.

WARNING: *Never cut the original cable between turbidimeter unit and its power supply unit. This cable must remain at full length.*

Coagulation pH meter:

- One (1) pH meters with probe is supplied pre-wired on top of each Actiflo® settling tank.
- Complete connection if any.
- Recommended supplier's wiring instructions are given in the supplier's manual.

Water level switch:

- One (1) water level switch is supplied pre-wired inside each Actiflo® settling tank.
- Complete connection if any.
- Recommended supplier's wiring instructions are given in the supplier's manual.

Operation & Maintenance Manual

ACP-700R
Actiflo® Package Plant

Project :
Meadowbank Mining CORP
Reference number:
NC01

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1.0 LIST OF EQUIPMENT

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A		ST-001 PROJECT SUMMARY		
B		ST-002 CONTROL AND AUTOMATION		
	001	Functional description		
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C		ST-003 VALVES		
	005	Bray, 31-119, Butterfly valve		V2-011/021, V6-013/023
	a	Bray, Series 92, Pneumatic actuator		
	b	Bray, Series 01, Manual operator		
	006	Milliken, 601E, Eccentric manual plug valve		V6-011/012/021/022, V2-012/013/022/023
	007	CFF, SS-1, Ball valve		
	008	Watts, 25-AUB-Z3-CG, Presure reducing valve		V7-010/011/012
	009	Asco, 8210G54, Solenoid valve		V9-521/522
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D		ST-004 PROCESS INSTRUMENTATION		
	011	Dwyer, F7-SS, Level switch		LSHH 2-011/2-021
	012	Basco, Model 761, Pressure gauge		PI 2-011/PI 2-012/2-021/PI 2-022
	013	Hach, SS7, Turbidimeter		AIT1-011
	a	Hach, 46680-00, Bubble trap		
	014	Khrone, Enviromag, Electromagnetic flowmeter		FIT-2-011, FIT-2-021
	a	Khrone, IFC100CD, Converter		
	015	Hach/GLI, PRO-P3A1N, pH-meter		pHIT 2-011/021
	a	Hach/GLI, PD1R1, pH sensor		pHE 2-011/021
	016	Hach, 1720E, Turbidimeter		AIT 2-011
	a	Hach, 60101-01, Sensor (for 1720E turbidimeter)		AE-2-011/2-021
	017	Chemline, FSA01500, Rotameter		F19-521/522
E		ST-010 SCRAPER		

	018	SEW Eurodrive, RF97/FA47, Scraper Gearbox	S2-011 / S2-021
	a	SEW Eurodrive, DT71D4/C, Motor	
	b	SEW Eurodrive, BLH, Load cell arrangement	
F		ST-011 MICROSAND	
	019	Microsand, 135 microns	
G		ST-051 COAGULANT DOSING	
	020	Hapman, Coagulant automatic preparation system	DF9-511
		c/w bulk bag unloader, hoist and trolley	
		c/w automatic bag agitator assembly	
		c/w Hapman U-Trough feeder	
		c/w mix tank and use tank	
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		c/w mix tank mixer	
	021	Seepex, BW 10 / A4-A7-A7-F0-GA-X, Progressive cavity pump	P9-515
	022	Seepex, MD 012-12 / A6-A7-A7-F0-GA-X, Progressive cavity pump	P9-511/512/513
	023	Primary Fluid, TVPR50-PVC-G, Safety relief valve	V9-515/516/517
	024	Primary Fluid, PV#2-100ml, Calibration tube	
	025	Primary Fluid, CCS-56-PVC, Corporation stops	
H		ST-052 POLYMER DOSING	
	026	Tomal, Polyrex 2.0, Automatic polymer preparation system	DF9-521
	027	Seepex, MD 025-6L / A6-A7-A7-F0-GA-X, Progressive cavity pump	P9-521/522/523
	028	Primary Fluid, TVPR50-PVC-G, Safety relief valve	V9-525/526/527
	029	Primary Fluid, PV#2-4000ml, Calibration tube	
I		ST-054 CAUSTIC SODA DOSING	
	030	Aco, OT-15 & OT-75, Tank and accessories	T9-541/542
	031	Lightnin, EV5Q-50, Mixer	M9-541
	032	Seepex, MD 006-12 / A6-A7-A7-R0-GA-X, Progressive cavity pump	P9-541/542/543
	033	Primary Fluid, TVPR50-PVC-G, Safety relief valve	V9-545/546/547
	034	Primary Fluid, PV#2-500ml, Calibration tube	
	035	Primary Fluid, CCS-56-PVC, Corporation stops	
J		ST-099 SERVICE WATER PUMP	
	036	Aurora, PVM18-60, Vertical multi-stage pump	P7-011/021
K		ST-100 MIXERS	

	037	Envirequip, Mix-Tech EVG Series, Mixers	
		Envirequip, Mix-Tech EVG 4-3.0, Coagulation tank	M2-011/021
		Envirequip, Mix-Tech EVG 4-3.0, Injection tank	M2-012/022
		Envirequip, Mix-Tech EVG 6-5.0, Maturation tank	M2-013/023
	a	Nord, SK4282 AHZ/VL - SK6282 AHZ/VL , Gear reducer	
	b	Nord, 100LH/4-112MH/4, Motor	
L		ST-101 MICROSAND RECIRCULATION PUMP	
	038	Linatex, Linapump Series IIIr 50x50, Microsand recirculation pump	P2-011/P2-012/P2-021/P2-022
M		ST-103 STEEL TANKS	
	039	John Meunier Inc., ACP-700R, Actiflo tank	
N		ST-150 HYDROCYCLONE	
	040	Krebs, U6-10-1758, Hydrocyclone	C2-011/012/C2-021/022
O		ST-151 LAMELLA	
	041	Nova Chemicals, Type Impact PS 6200 , Settling lamella	
P		ST-999 SLUDGE TANK	
	042	Aco, OT-750, Tank	T4-011
Q		DRAWINGS	
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2.0 INTRODUCTION

2.1 GENERAL INFORMATION

The components of the Actiflo® dynamic clarifier are supplied by **John Meunier Inc** Products. This equipment of superior quality and proven design will insure years of operation without problems. However, in order to maintain peak efficiency and performance of the system, it is imperative to take into consideration the preventive measures and procedures described in this manual. These measures include the operation and maintenance of its components.

To obtain any additional information regarding characteristics, operation or maintenance of this equipment, or if a problem persists, please do not hesitate to contact us.

The **Actiflo**® system was manufactured in Canada by:

John Meunier Inc
4105, Sartelon
Saint-Laurent, Qc.
Canada H4S 2B3
Phone: (514) 334-7230
Fax: (514) 334-5070

2.2 OBJECTIVES OF THIS MANUAL

- Describe and explain the functions of the various components of the Actiflo® clarifier.
- Describe the procedures for the start-up and standard operation of the system.
- Plan preventive maintenance measures and describe procedures for the regular maintenance of the equipments.

2.3 SAFETY

Operation of the **Actiflo**® system should be done by qualified personnel only.

It is imperious to insure the security of all operators during the operation and maintenance of all mechanical equipment. In order to avoid accidents, it is important to determine the correct way to proceed and conveniently select appropriate clothing for the job. All workers having access to the equipment must scrupulously respect all the standard rules of safety as well as the precautions described in this manual.

Workers, which are directly responsible for the operation and maintenance of the equipment, must be aware of standard rules of safety.

The following safety rules should be followed:

- Safety devices such as handrail and belt guards should be installed and inspected regularly.
- Access to the building should be limited to authorize personnel only.
- Non-authorized personnel must never in any case approach rotating shafts, connections, roller bearings, etc., in order to avoid accidents.
- The owner should implement a safety program and provide training for operation staff.
- Material Safety Data Sheets (MSDS) should be available for each chemical product.
- Appropriate protective gear including safety glasses, helmet, boots, garment, gloves, and ear protection should be worn at all times.

Protection systems, or any other type of safety device supplied by the manufacturer, must be carefully installed. If these are not supplied by the manufacturer, the user must himself supply and install the safety devices necessary for the protection of employees responsible for the operation of the equipment.

WARNING: The lamella pack is pre-installed in the settling tank section of the Actiflo® clarifier. It is made of a very flammable material. Do not expose it to open flames or sparks. Do not allow any welding works nearby unless special precautions have been taken.

WARNING: The operation staff should be aware that coagulant is highly corrosive and polymer solution can be very slippery. Spills should be cleaned immediately according to the MSDS instructions.

2.4 STANDARDS

Unless specified otherwise, the equipments described in this manual are consistent with the most recent construction standards that are applicable, including:

American Society of Mechanical Engineers	(ASME)
Canadian Standards Association	(CSA)
Canadian Electrical Manufacturers Association	(CEMA)
National Electrical Manufacturers Association	(NEMA)
American Society for Testing and Materials	(ASTM)
American National Standard Institute	(ANSI)

2.5 WARRANTY & PROCESS GUARANTEE

See Purchase Order terms.

2.6 ACTIFLO® CLARIFICATION PROCESS

2.6.1 General information

The Actiflo® process is a compact system that will provide quality water by a flocculation and a high rate settling process.

Suspended particles and dissolved solids, previously destabilized with the injection of a coagulant in the raw water, are fixed to the microsand with the help of a flocculant (polyelectrolyte) added to water. The floc being formed is subsequently separated from the water by counter-current lamellar settling with an ascending hydraulic flux.

Excellent efficiency of the Actiflo® process is reached using two proven techniques:

- injection of microsand serves as support to the ballasted flocs and works as weight in order to create a very dense floc, thus providing a very high rate of sedimentation.
- lamellar settling allows increased settling surface in a reduced tank volume by using a set of inclined parallel plates.

2.6.2 Operation principles

Raw water goes through four successive steps that are part of the Actiflo's® treatment process.

1) Coagulation:

Raw water is mixed with a coagulant using a rotating mixer in a rectangular-shaped tank. This insures a homogeneous diffusion of the coagulant in the water. The standard hydraulic retention time for this step is approximately two (2) minute at nominal flow rate.

2) Injection:

A precise amount of microsand and flocculant (polyelectrolyte) are added and mixed in the water using a rotating mixer in a rectangular-shaped tank. The energy induced by the mixer accelerates the contact between the flocs, the polyelectrolyte and microsand, thereby insuring the formation of ballasted flocs. The standard hydraulic retention time for this step is approximately two (2) minutes at nominal flow rate.

3) Maturation:

The flocs previously formed are then maintained in suspension for a certain time in a large rectangular tank with the help of a rotating mechanical mixer. The smooth agitation of the water insures a gradual increase in floc size, reaching floc maturation. The standard hydraulic retention time for this step is approximately six (6) minutes at nominal flow rate.

4) Counter-current lamellar settling:

Ballasted flocs precipitate to the bottom of a hopper and the clarified water is collected at the surface using troughs. The sludge is drawn out of the hopper by a pump and is directed toward a series of hydrocyclones. The hydrocyclones located above the injection tank separates the microsand from the sludge. The microsand gets recirculated into the system via the underflow of the hydrocyclones while the sludge is evacuated through the overflow. The hydraulic retention time for the settling step is about three (3) minutes at nominal flow rate.

2.6.3 Characteristics and performances

By combining ballasted flocculation with lamellar settling, the Actiflo® process allows the water to reach rise rates in the clarifier. Therefore this technique provides excellent control and stability in spite of variations in flow rate, temperature, pH or turbidity of the raw water.

The Actiflo® process also accepts activated carbon dosages aimed at reducing taste and odours.

When the flow rate is set at its maximum value, the needed time to complete all three (3) stages of treatment, i.e. coagulation/flocculation/maturation, is only 10 minutes. This very short hydraulic retention time enables the process to respond quickly to adjustments in chemicals dosage. Ballasted flocculation produces high quality clarified water, even when operating under difficult conditions, such as very cold and/or very coloured waters or waters with a high turbidity.

Actiflo® pilot plant tests have demonstrated the efficiency of this process as well as its ability to rapidly respond to important changes in raw water flow rate and/or characteristics.

3.0 DESCRIPTION OF COMPONENTS

3.1 ACTIFLO® CLARIFIERS

3.1.1 General description

An Actiflo® clarifier is composed of coagulation, injection and maturation tanks, a lamellar settling tank with a hopper, a series of lamellar plates, troughs for the collection of clarified water, a microsand recirculation circuit, piping and a control panel.

3.1.2 Coagulation tank

Raw water enters the **Actiflo®** at the bottom of the coagulation tank through a pipe with a coagulant previously injected upstream to improve contact time.

The coagulation tank is usually equipped with a mechanical mixer composed of a shaft and a three-bladed propeller made of stainless steel. The mixer is vertically mounted and the induced water flow direction is downward.

The mixer is driven by a motor and a helical gear speed reducer. It is a Totally Enclosed Fan Cooled motor (TEFC) and operates at a constant speed. In case of thermo-mechanical overload, the motor stops automatically and an alarm warns the operator.

A manual drainage valve located in the coagulation tank allows draining this tank through the existing draining network.

3.1.3 Injection tank

Coagulated water enters the top portion of the injection tank by going over a flooded overflow, which communicates directly with the coagulation tank. An accurate amount of microsand and polymer is added at the tank water surface. The polymer may also be directly added in the bottom injection or maturation tanks.

The injection tank is equipped with a mechanical mixer composed of a shaft and a three-bladed propeller made of stainless steel. The mixer is vertically mounted and the induced water flow direction is upward.

The mixer is driven by a motor and a helical gear speed reducer. It is a Totally Enclosed Fan Cooled motor (TEFC) and operates at a constant speed. In case of thermo-mechanical overload, the motor stops automatically and an alarm warns the operator.

A manual drainage valve located in the injection tank allows draining this tank and the maturation tank through the existing draining network.

3.1.4 Maturation tank

Water and flocculated solids originating from the injection tank enter at the bottom of the maturation tank through a common opening.

The maturation tank is equipped with a mechanical mixer composed of a shaft and a three-bladed propeller made of stainless steel. The mixer is vertically mounted and the induced water flow direction is downward. The maturation tank is equipped with baffles to insure better mixing.

The mixer is driven by a motor and a helical gear speed reducer. It is a Totally Enclosed Fan Cooled motor (TEFC) and may operate at a constant or variable speed. An adjustment to the rotating speed can be proven necessary when the incoming water flow rate is greatly reduced. In this case, it might be advantageous to compensate for losses in hydraulic energy by increasing the speed of rotation of the maturation mixer. In case of thermo-mechanical overload, the motor stops automatically and an alarm warns the operator. The unit automatic shutdown sequence is also initiated.

A manual drainage allows draining the maturation tank through the existing draining network.

3.1.5 Settling tank

The settling tank is composed of a set of lamellas, a sludge collection system and a clarified water collector.

The water coming from the maturation tank contains a suspension of microsand-ballasted flocs and enters the settling tank bottom by going through a vertical baffle. Most of the solids settle in the hopper while clarified water flows through the lamella pack to the clarified water troughs.

3.1.5.1 Lamella pack

The lamella pack consists of several polystyrene plates positioned at an angle of 60° with respect to the horizontal axis. They are disposed in such a way that they form hexagonal-shaped cells (honeycomb).

Smaller solids that did not settle directly in the hopper will deposit on the lamella pack surface during the water ascension into it and go down to the sludge collection hopper by its own weight. Clarified water flows upwards to the collection troughs and out of the clarifier.

WARNING: The lamella pack is installed in the settling tank section of the Actiflo® clarifier. It is made of a very flammable material. Do not expose it to open flames or sparks. Do not allow any welding works nearby unless special precautions have been taken.

3.1.5.2 Sludge collection hopper

The collection of sludge takes place within a pyramidal hopper located in the settling tank under the lamella pack where the settling solids are pumped to the hydrocyclones.

3.1.5.3 Circular scraper

The settling tank has a circular scraper equipped with a galvanized steel drive shaft and steel scrapers. Rubber scrapers are fitted on to the metal support. The scraper is mounted vertically.

The scraper moves the microsand that has settled at the bottom of the hopper to its center where a basin captures the accumulated sludge.

The scraper is powered by a speed/ratio reducer motor. This motor is Totally Enclosed Fan Cooled (TEFC).

3.1.5.4 Clarified water troughs

Clarified water is collected above the lamellas modules by stainless steel troughs. The dimension and position of the square-edged notches are calibrated in order to obtain an optimal hydraulic distribution of the flow rate inside the settling tank.

3.1.5.5 Partial drainage

A manual valve, installed below the settling lamellas, allows for partial draining of the settling tank to facilitate the preventive maintenance of the lamellar plates.

3.1.5.6 Complete drainage

There is two ways to achieve a complete drainage of the clarifier:

- 1) By opening the coagulation, injection and hopper drain manual valves.
- 2) By opening the coagulation and injection manual drainage valves and let the recirculation pump on.

3.1.6 **Microsand recirculation piping**

3.1.6.1 Collection of sludge and microsand

Sludge containing microsand is collected in the hopper and pumped to the hydrocyclones through galvanized steel pipes and flexible non-abrasive pipes that can withstand highly abrasive conditions.

In case of clogging, a clean-out assembly is provided to backwash and flush the suction line by connecting a pressurized service water hose.

3.1.6.2 Microsand recirculation pumps

The clarifier is provided with a centrifugal pump equipped with a pulley and drive belt arrangement. A backup pump is also supplied. The backup pump will be used in supplement of the first pump when high turbidity Spring runoff is reached. The impeller and the inside of the volute are coated with a material (usually natural rubber) resistant to microsand abrasion. The motor is Totally Enclosed Fan Cooled (TEFC). In case of a thermo-mechanical overload, the motor will automatically shut down and an alarm will warn the operator.

The recirculation pump operates at a constant pressure. An increase in pressure may be caused by an obstruction of the discharge pipe, and a decrease in pressure may be caused by unpriming of the pump or an obstruction of the inlet pipe.

3.1.6.3 Hydrocyclones

The sludge and microsand are pumped by the recirculation pump to a hydrocyclone in which the microsand gets separated from the sludge particles. This process allows the recycling of clean microsand back into the system. Sludge-microsand separation is accomplished by a vortex effect exerting a centrifugal force on the mixture of particles. The microsand grains, more dense than sludge particles, descend along the internal surface of the hydrocyclone, while the sludge particles ascend. The microsand is returned to the injection tank whereas the sludge is evacuated out of the system.

3.1.7 Microsand

The dosage of microsand into the injection tank along with the polyelectrolyte (polymer) solution, serves as support for the flocs growing. The floc, ballasted with the microsand grain, becomes considerably heavier and therefore can settle more rapidly. The microsand has the following characteristics:

- Effective size: 85 µm
- Uniformity coefficient: < 1.6
- It is available in bags of 22.7 kg (50 lb)

A small portion of the microsand is lost in the process; therefore periodic addition of microsand in the system is required. Microsand is available from JMI.

3.1.8 Coagulant

The coagulant to be used can either be alum ($\text{Al}_2\text{SO}_4\cdot 14\text{H}_2\text{O}$), PASS (Poly Aluminum Silicate Sulphate) or PAC (Poly Aluminum Chloride). It is injected at the head of the process directly into the pipe leading to the tank.

By reacting with the alkaline components of the water, the coagulant forms a precipitate, which sticks to the colloidal particles in suspension and organic components in the raw water, thereby producing a floc. In some cases, an alkali (ex. caustic soda) must be added to the water upstream of the clarifier, prior to the addition of coagulant.

The coagulant gets rapidly dispersed in the water when it is introduced into the coagulation tank.

WARNING: The operation staff should be aware that coagulant is highly corrosive. Spills should be cleaned immediately according to the MSDS instructions.

3.1.9 Flocculant (polyelectrolyte)

The polyelectrolyte is a white powder generally sold in big bags. The powder is naturally hygroscopic so it must be stored in a dry environment.

Polyelectrolyte is pumped into the injection and maturation tank along with the microsand. It forms a coating on the microsand particles in order to activate them and facilitate fixing of the floc onto the sand particle surface. Other injection points of polymer can also be used, that is, at the inlet of the maturation tank and at various locations inside the maturation tank.

WARNING: The operation staff should be aware that polymer solution could be very slippery. Spills should be cleaned immediately according to the MSDS instructions.

3.1.10 Control panel

The **Actiflo**® clarifier operation is fully automated but manual control is possible from the control panel interface. The control panel normally includes but is not limited to components such as fuses, starters, selectors, warning lights, PLC (Programmable Logic Controller) and operator interface.

The electrical circuit of the control panel performs the necessary functions for a fully automatic operation and equipment protection of the **Actiflo**® unit. The control panel gives the operator access to every mechanical component of the system. In addition, all the alarms are channelled through the control panel, which in turn warns the operator in the event of equipment malfunction.

Refer to document ST-002 «Functional description of control system» of Appendix «Control & Automation» for a control panel detailed description.

4.0 START-UP & OPERATION

4.1 START-UP

4.1.1 Preliminary verification

Before starting the **Actiflo**®, the following points must be checked:

- Remove any debris from the settling tank to prevent hydrocyclone clogging;
- Every section of the **Actiflo**® must be filled with water;
- Valves configuration on the microsand recirculation lines is adequate;
- Chemical metering systems must be ready to operate;
- Chemical storage tanks must be full;
- Chemical metering pumps must be calibrated and set for the desired dosage. These can however be adjusted once that the system is operational;
- All the field instruments must be calibrated (flowmeter, pressure transmitter);
- Verify the oil level in the mixers reducers and the recirculation pumps;
- Verify the rotation of each mixer;
- Verify the rotation of each recirculation pump; remove the belt to prevent impeller unscrewing if the rotation is the wrong way;
- Verify the proper installation of the mixer's impellers, specially the height above tank floor (see Technical Sheet);
- Adjust motor overload protection to the proper value as indicated on each motor's nameplate;
- Record the pressure at the hydrocyclone inlet; the gauge should indicate 15 PSI (103.4 kPa).

Once all these conditions have been checked, the system can be put into operation.

4.1.2 Initial microsand loading

The standard microsand load in an Actiflo® clarifier usually ranges from 2 to 3 kg per m³/h of clarified water produced.

The addition of microsand is done by pouring it directly in the injection tank until the required concentration is reached. It is preferable to begin by adding a small quantity of microsand and measure the resulting microsand concentration in the hydrocyclone underflow after a whole recirculation cycle has been completed (15-20 minutes). The quantity of microsand should be increased until the optimal concentration in the underflow is reached (typically 80 to 200 ml/litre).

4.1.3 Automatic start-up

Refer to document ST-002 «Functional description of control system» of Appendix «Control & Automation» to start the **Actiflo®** system in automatic mode.

4.2 NORMAL OPERATION

Note: In the case of a discrepancy between this section of the Manual and the Functional description of control system, the later shall prevail.

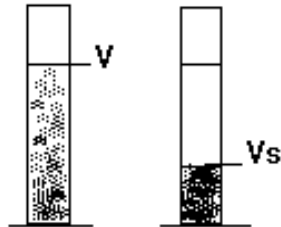
4.2.1 Actiflo® clarifiers

4.2.1.1 Microsand monitoring

Although a minor amount of microsand is constantly discharged out of the process and a sand concentration as low as 2 g/l is sufficient for satisfactory operation of the ACTIFLO process, the microsand concentration should always be maintained at recommended levels (3-6 g/l). This insures that the system is always prepared to treat the worst possible raw water conditions. Therefore, the operators should monitor the microsand concentration 2-3 times per day. The concentration can easily be estimated using the following method.

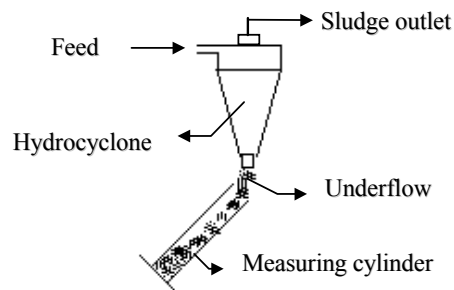
Sampling (system concentration from hydrocyclone underflow)

- a. Verify that each operating hydrocyclone has an uninterrupted conical discharge. If you have a splashguard covering the apex tip, place it in the up position to verify this. After verification the splashguard should be returned to the down position prior to sampling.
- b. Obtain a 1000-2000 ml graduated cylinder to take the hydrocyclone underflow sample. Samples can be taken from a portion of the underflow discharge. However, it is important to be consistent and obtain the sample from the identical section of the underflow discharge every time a grab is taken. If the underflow discharge is constantly or periodically roping, the underflow discharge should be sampled with a swirling motion that catches the outer and center portions of the underflow in each sample.
- c. Fill the cylinder as close to the 1000 ml or 2000 ml mark as possible without over spilling. Caution: The 1000 ml cylinder may fill quickly and with force.
- d. Allow the sample to settle for 3 minutes.
- e. Record the volume of the settled sand (V_s) in ml along with the total sample volume (V) in ml. See figure below.



- f. Repeat steps c through e on the same hydrocyclone two more times.
- g. Use the same sampling procedure as you did on the first hydrocyclone and repeat steps c through f for all hydrocyclones in operation on the system. For example if you have two hydrocyclones operating on a given system you should have six values for V_s and six values for V .
- h. To determine the concentration of sand in the entire system you must next average all collected values of V_s . Also, average all collected values of V . Now you can use the following two equations provided in section 3 and 4 below to first determine C_s (the microsand concentration in the hydrocyclone underflow) and lastly C_m (the microsand concentration in the ACTIFLO system).

Note: For the most accurate determination of microsand in any given system the sampling procedure above should be performed three times throughout a 24-hour period. Three separate values of C_m should be averaged to determine one final microsand concentration for the day. It is also important to record and trend the final daily value of C_m to give indication of microsand loss over an extended period of time.



Sand Concentration of Hydrocyclone Underflow

The microsand concentration of the hydrocyclone underflow is calculated with the following formula:

$$C_s = \frac{1000}{V} \times V_s \times 1.7$$

Where:

C_s : Microsand concentration in the hydrocyclone underflow (g/l)
 V : Sample volume taken in a graduated cylinder (mL)
 V_s : Volume of the settled microsand after settling for 3 minutes
 1.7 : Density of the settled microsand

System Sand Concentration

Knowing the flow rate of the hydrocyclone underflow (gpm) and the microsand concentration (g/l) of the hydrocyclone underflow, the microsand concentration (g/l) in the ACTIFLO system is determined using the following formula:

$$C_m = \frac{UF \times N \times C_s}{Q_{\text{influent}}}$$

Where:

C_m : Microsand concentration in the ACTIFLO system, g/l
 C_s : Microsand concentration in the hydrocyclone underflow, g/l
 UF : Hydrocyclone underflow flowrate, 3.5 gpm
 N : No. of hydrocyclones in operation
 Q_{influent} : Influent flow rate, gpm

Microsand addition

Some microsand is lost at the hydrocyclones overflow and at the **Actiflo**® effluent. Periodical microsand addition is required to compensate for these losses. The addition of microsand is done directly in the injection tank. Since microsand contains a small proportion of very fine particles, the turbidity of the clarified water could increase slightly for a short period following the addition of microsand.

In standard operation mode, if a sustained increase of the raw water turbidity happens, it may be necessary to increase the concentration of microsand in the system to maintain the removal efficiency.

4.2.1.2 Microsand recirculation pumps

Each **Actiflo**® has two recirculation pumps and associated piping. The pumps are each protected by a pressure transmitter. Alarms will be issued in any of the following situations:

- Thermo-mechanical overload of the pump: this is normally a sign of overheating of the pump motor and can be caused by a mechanical breakdown or a pressure surge. The operator must correct this problem by verifying the pump and motor as well as the outlet piping, and then reactivate the overload relay located inside the control panel.

When an alarm is activated, the pump stops automatically and the alarm light blinks on the control panel. The operator must acknowledge the alarm by pressing the ALARM ACKNOWLEDGE button located on the control panel, fix the problem and then reset the system by pressing the ALARM RESET button. The pump will restart automatically.

It is essential that the recirculation pump be in operation continuously. When the pump stops, sludge and microsand accumulate in the hopper; this may clog the recirculation line. When the recirculation pump needs to be stopped, the mixer in the maturation tank must be stopped first, followed by a 30 minute delay before stopping the pump. This allows the hopper to be emptied before stopping the pump. The 30-minute delay is pre-programmed and can be adjusted by the operator on the control panel.

4.2.1.3 Hydrocyclones

The operator must make sure that the hydrocyclone outlets are free of obstruction at all times. Debris as small as 13 mm (1/2") can clog the underflow.

Waste sludge is evacuated from the **Actiflo**® at the hydrocyclone overflow (70% to 90% of the hydrocyclone flow rate). A small amount of microsand is lost at the overflow. It is important to check on a daily basis if the loss is higher than normal. This can be verified by collecting a 1-liter sample of the overflow into an Imhoff cone and measuring the volume of settled microsand after 2 or 3 minutes. Record the value and compare it with past measurements. See troubleshooting section.

The same procedure is used to measure the concentration of sand at the hydrocyclone underflow (10% to 30% of the hydrocyclone flow rate):

- Collect a 1-liter sample from the underflow (mixture of microsand and water).
- Allow the sample to settle for 2 or 3 minutes and then measure the volume of settled microsand.
- The volume of microsand should range between 80 and 200 ml per litre of water (typical).

4.2.1.4 Mixers

The mixers all have specific rotation direction and speed. In the event of a mixer motor overload, the mixer automatically stops and an alarm warns the operator. The operator must press the ALARM ACKNOWLEDGE button, correct the problem, and then reset the system by pressing ALARM RESET button. If the operator cannot correct the problem, the **Actiflo**® should be shut down, as it is impossible to produce clarified water with a mixer out of service.

4.2.1.5 Circular Scraper

When an overload occurs to the scraper's motor or when a very high torque is detected, the motor shuts down automatically and an alarm warns the operator and the **Actiflo** will stop as per the stop sequence.

4.2.2 Dosage of chemicals

4.2.2.1 Coagulant

The coagulant is injected into the raw water feed line.

The concentration of coagulant at the inlet of the system depends on the type of coagulant used.

In either case, the dosage to be used varies according to the characteristics of the raw water. An increase in turbidity of the raw water must signify an increase in product dosage. The proper dosage is determined by a jar test.

The concentration of coagulant at the inlet of the system is calculated from the flow rate of the raw water and metering pumps:

$$\text{Coagulant concentration (mg/L)} = \frac{\text{metering pump rate (mg/h)}}{\text{raw water flow rate (L/h)}}$$

4.2.2.2 Flocculant (polyelectrolyte)

The polyelectrolyte is used in solution with a concentration ranging from 0,5 to 2.5 grams per litre; the produced solution is viscous. In order to obtain a high-quality polymer, it is recommended to use non-chlorinated filtered water for its preparation and transport. The concentration of polyelectrolyte in the clarifier should be between 0.40 to 0.90 mg/L. Depending on the quality of the raw water, this concentration can be increased or decreased. The polyelectrolyte concentration in the system is calculated from the flow rate of the raw water and metering pumps:

$$\text{Polyelectrolyte concentration (mg/L)} = \frac{\text{metering pump rate (mg/h)}}{\text{raw water flow rate (L/h)}}$$

The ideal dosage of polyelectrolyte can be determined with a jar test (See jar test procedure in this manual).

Insufficient polymer dosage will cause free flocs to appear that are not ballasted by the microsand and which will not be correctly eliminated in the settling tank. The clarified water might have a higher turbidity and/or color, and an important aluminum concentration.

However, excess in polyelectrolyte dosage can produce very sticky sludge, which is difficult to recycle.

4.2.2.3 Alkali, pH adjustment

The water's pH is the most important factor to consider in a coagulation process. When using alum, maximum coagulation efficiency is reached when pH readings are between 5,5 and 7,0. If the raw water has a low pH, it is important to increase it by adding an alkaline product (ex. caustic soda, etc.) to the water upstream of the coagulation step.

Upstream of the coagulation step, the hydraulic residence time of the alkali must be long enough, allowing time for it to completely dissolve in the water, increasing the precision in the adjustment of the water's pH.

5.0 SURVEY OF OPERATIONS

In order to insure a reliable survey of the Actiflo® system operation, and to provide the operators with a useful data bank, we suggest to the operators to record the following parameters:

on a hourly basis:

- turbidity, raw water;
- color, raw water;
- pH, raw water;
- turbidity, clarified water;
- color, clarified water;
- pH, clarified water;

every eight hours:

- flow rate, raw water;
- flow rate, coagulant metering pump, and calculated concentration;
- flow rate, polyelectrolyte metering pump, and calculated concentration;
- flow rate, alkali metering pump, and calculated concentration;
- alkalinity, clarified water;
- pressure at the recirculation pump outlet;
- pressure at the hydrocyclones inlet;
- microsand concentration at the hydrocyclone underflow.

on a daily basis:

- total quantity of clarified water;
- mixers speed;
- electric current drawn by the mixers;
- other parameters of interest: dissolved iron and manganese, total organic carbon...
- alkalinity, raw water
- average raw water flow

on a weekly basis:

- flow rate of the hydrocyclone underflow;
- flow rate of the hydrocyclone overflow.

5.1 AUTOMATION

Refer to document ST-002 «Functional description of control system» of Appendix «Control & Automation».

5.2 SHUT DOWN

In manual mode, when the microsand recirculation pump needs to be stopped, the following procedure must be followed in order to prevent possible clogging problems.

- Stop the mixer in the maturation tank. This allows the microsand to settle in the maturation tank instead of in the hopper.
- After approximately 30 minutes, verify that the underflow of the hydrocyclone does not contain any microsand.
- The microsand recirculation pump can then be stopped without any risk of clogging the recirculation line.

5.3 TROUBLESHOOTING

5.3.1 Increase in clarified water turbidity

The turbidity of the clarified water should normally be between 0.4 and 1.0 NTU. If the turbidity exceeds 1,0 NTU, verify:

- the flow rate of raw water: if it is greatly increased or diminished, dosage flow rate of coagulant and polyelectrolyte should be adjusted in consequence;
- the flow rate of coagulant and polyelectrolyte: the metering pumps must inject an accurate dosage of these chemicals, such that the desired concentrations in the system can be obtained;
- the quality of raw water: if the turbidity, colour and/or the alkalinity of the raw water are increased or decreased, it is normally necessary to adjust the concentration of coagulant in the system. This dosage can be predetermined with the help of a jar test. However, a change in the quality of the raw water does not usually require an adjustment in polyelectrolyte concentration.
- the concentration of microsand in the underflow of the hydrocyclone: this must approach a value between 80 and 200 ml/L. Deterioration in the raw water quality can necessitate an increase in the quantity of microsand in the system.

- sludge-sand recirculation rates: these flow rate generated by the recirculation pump must be kept constant.
- rotation speeds of the injection and maturation mixers: these speeds can be read directly on the display of the corresponding variable frequency drive.

5.3.2 Increase in clarified water colour

See section 5.3.1.

5.3.3 Stopping of microsand recirculation pump

In manual mode, when the microsand recirculation pump needs to be stopped, one must, in order to prevent possible clogging problems, proceed as follow:

- stop the mixer in the maturation tank. This allows the microsand to settle in this tank instead of in the hopper;
- after approximately 30 minutes, verify that the underflow of the hydrocyclone does not contain anymore sand;
- afterwards, one can stop the pumping of sand without any risks of clogging the microsand recirculation circuit.

5.3.4 Power failure

Refer to the section « Power Failure » of the ST-002 «Functional description of control system» of Appendix «Control & Automation».

6.0 JAR TEST PROCEDURE

6.1 INTRODUCTION

In order to simulate the ACTIFLO® process, a modified Jar test procedure was developed. The procedure can be used to find the adequate coagulant and polymer dosages and the optimum pH of coagulation to obtain settled water low in turbidity and with a high filterability index. Furthermore, the modified Jar test procedure has the capability to evaluate or predict process performances of an existing ACTIFLO® unit and bring accurate diagnosis on operating troubleshooting.

6.2 MATERIAL REQUIRED

- Phipps & Bird Jar Test apparatus or equivalent lab stirrer allowing up to 300 RPM rotational speed.
- Circular beakers (1litre)
- Microsand
- Polymer (Allied Colloids, serial LT or equivalence)
- Coagulant (Alum, ferric chloride, PAC, PASS 100 or equivalence)
- Acid or base for pH and alkalinity adjustment (NaOH, aluminates, HCl, H₂SO₄, lime, carbonate, bicarbonate, CO₂, or equivalence)
- Turbidimeter (Hach 2100AN or equivalence)
- pH-meter (serial Hach EC or equivalence) and calibration solutions (pH=4, pH=7 and pH=10)
- Chronometer or stopwatch

6.3 LABORATORY PROCEDURES

1. Note settled and raw water parameters values at the plant (turbidity, colour, dissolved aluminum, etc.) if the purpose of this test is to simulate the full-scale unit.
2. Fill up the 1-liter beakers with raw water.
3. Set the beakers on the bench.
4. Make sure raw water temperature corresponds to the desired temperature.
5. Start mixing
6. Add acid, base or equivalence and adjust at the optimum coagulation pH.
7. Add coagulant simultaneously in all beakers with micro-syringes from 0, 0.5, 1.0, 2.0 or 5 minutes after reaching the right pH in accordance with contact times simulated.
8. Two minutes after adding coagulant, add micro-sand and the polymer (half the dosage) using a pipit.
9. Two minutes after adding micro-sand and polymer.
10. After a maturation contact time of 6 minutes, stop stirring and allow the water to settle for the next 3 minutes.
11. Sample settled water from 5 to 10 cm below the supernatant surface using a 100-ml syringe. Proceed slowly. Make required analysis.

6.4 ANALYSIS

Turbidity, colour and other parameters

1. Measure turbidity (NTU) using a turbidimeter.
2. Measure apparent colour (ACU) using a spectrometer.
3. Measure pH using pH-meter.
4. Measure any other required parameters.

7.0 MAINTENANCE

7.1 ACTIFLO® CLARIFIER

7.1.1 Lamella pack

At least once a month or as required, clean the lamella pack. To do so, stop the mixers; partially drain the clarifier such that the lamellas are exposed (use the partial drainage valve located on the **Actiflo®** hopper). The lamella can then be cleaned using a pressurized water jet. Remove any substance that is stuck to the settling module and which could interfere with the process efficiency.

7.1.2 Mixers

For each mixer:

- Make sure that the gearbox remains clean.
- Check on a regular basis the oil level in the gearbox.
- Change the oil in the gearbox.
- Refer to the mixer supplier manual for more information.

7.1.3 Microsand recirculation pumps

- Check on a regular basis the oil level in the bearing housing chamber.
- Proceed daily to a visual inspection of the packing adjustment.
- Every 1000 hours of service (6 weeks at 24 hr/day), lubricate the bearing housing chamber.
- Once a year, proceed to an inspection of the pump: dry-seal, impeller, rubber coating, bearings, etc.
- Refer to the pump supplier manual for complete inspection and maintenance requirements.

7.1.4 Hydrocyclones

- After the first year, inspect the inside surface. Replace worn down sections, if needed. The first inspections will determine the frequency of replacement.
- Refer to the hydrocyclone supplier manual for complete inspection and maintenance requirements.

7.1.5 Scraper

- Every 8700 hours of continuous operation, change the oil on the reduction motor.

7.2 CONTROL PANEL

For each panel, including junction boxes:

- Replace fuses when needed.
- In case of an electrical problem other than a fuse, contact a certified electrician and verify the circuits.
- Refer to the appropriate drawings.

7.3 INSTRUMENTATION

For each meters equipment:

- Calibrate on a regular basis.
- Refer to the supplier manual for calibration instructions and maintenance requirements.

7.4 VALVES

7.4.1 Manual valves

- No preventive maintenance required.
- Refer to the supplier manual.

7.4.2 Automatic valves

- Refer to the supplier manual.

7.5 PERIPHERAL EQUIPMENT

- Any other peripheral equipment needing maintenance should be inspected on a regular basis.
- Refer to the supplier manual.

ACTIFLO® PROJECT SUMMARY ST-001

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TITRE/ TITLE		Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining		
Project Summary		0	SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26				
		1								
		2								
		3						REF. No.	NC01	0
DESSIN /DWG #		ST-001								
REV.	ITEM	QTE/QTY. Unit. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	Date: 2009-03-26		
								P / N		
			ACTIFLO PROCESS							
			GENERAL							
			Application:							
			Process water							
			Number of units:							
			2							
			Manufacturer:							
			John Meunier Inc.							
			Model:							
			ACP-700R							
			Nominal capacity of ACP-700:							
			12500 m³/d							
			Nominal flow rise rate of ACP-700:							
			40 m/h							
			Retention time at nominal flow of ACP-700							
			coagulation tank							
			2 min.							
			injection tank							
			2 min.							
			maturation tank							
			6 min.							
			Required capacity:							
			25 000 m³/d							
			Required flow rise rate:							
			80 m/h							
			Retention time at required flow							
			coagulation tank							
			1 min							
			injection tank							
			1 min							
			maturation tank							
			3 min							

**NOMENCLATURE/
BILL OF MATERIALS**

TITRE/ TITLE		Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining	
Project Summary			0	SUBMITTAL		P.S.M.	2009-03-26		
			1						
			2						
			3						
DESSIN /DWG #		ST-001	4					2009-03-26	
REV.	ITEM	QTE/QTY.	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N	
		Unit.							
		Total							
			SETTLING TANK						
			Height of lamella pack:						
			30" (762 mm) vertical						
			Angle:						
			60 degrees from horizontal						
			Collection troughs:						
			4 per unit						
			RECIRCULATION SYSTEM						
			Quantity of complete recirculation line:						
			2 per unit, 1 duty and 1 stand-by each recirculation line has one pump and one hydrocyclone						
			Recirculation rate:						
			3.3% @ required flow rate capacity with one pump running						
			Recirculation flow:						
			34 m³/h per recirculation line						
			Sludge production flow:						
			27 m³/h per recirculation line						

CONTROL AND AUTOMATION ST-002

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**Two Actiflo®
Functional Description
TS-002**

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1 General description

The Meadowbank Mining Corp. designated John Meunier Inc. as the supplier of two Actiflo® units. The designed rated flow is 50 000 m³/day.

The following document describes the typical operation of the system. John Meunier Inc may be unable to supply some of the described components.

1.1 Control layout

An Allen Bradley SLC 5/05 16k PLC is installed; it is located within a steel NEMA 12 control panel.

The maturation mixer motor is powered by a VFD. All other motors are powered by DOL starters. All motors are started by a Motor Control Center (MCC) provided by another supplier.

The control panel is equipped with an Allen Bradley PanelView Plus 600 touch-screen communicating with the PLC through an Ethernet network. An Ethernet HUB is installed in the panel, interconnecting the PanelView and PLC.

1.2 Hardware connection

All motors and instruments are controlled and powered by the system's panel. The Actiflo® unit pre-cabling to junction boxes is done at the plant by John Meunier Inc. The cabling between junction boxes and the control panel will be provided by John Meunier. Panel connections will be done by others.

1.3 List of controlled equipments

Refer to panel drawings and build of material for a complete list of devices controlled from the PLC.

1.4 Control panel components

View panel drawings for a complete list of components.

1.5 Local control

On the control panel's door, we find an HMI-type operator interface allowing process and alarm monitoring operations such as acknowledgement and reset of alarms.

We can also find a mushroom-head, "push & pull" pushbutton for emergency stop.

Buttons and pilot lights are installed on the panel's door.
Pilot lights show current operational conditions.

"POWER ON"	Panel is powered
"ALARM" blinking	Activated but unacknowledged alarm signal
"ALARM" steady	Alarm signal is acknowledged
"ALARM" off	No current alarm.

Pushbuttons:

1. Alarm acknowledgement
2. Response to fault (resetting of VFD and scraper torque alarm)
3. Emergency stop (mushroom-head button)

1.5.1 Pushbutton and pilot light colors

Pilot lights:

1. Power on = white
2. Alarm = red

Pushbuttons and selectors:

1. Alarm acknowledgement = black
2. Fault response = black
3. Emergency stop = red

1.5.2 Override module

An override module is a component installed within the control panel that allows the operation of a motor or valve in non automated mode. It is a mode used only when a control system component failure occurs. Only cabling types of protection are active. See the specific description of each component for further details.

1.5.3 Local station

When needed, a local station, which comprises a Hand-Off-Auto selector, is installed in the area of equipments to be controlled.

1.5.4 Transmission of signals (outward from panel)

Here are wired-logic transmitted signals available at system's panel:

- Dry contact, general alarm
- See specific sections for other signals

These signals are planned in a standard way and might be used during start-up and/or troubleshooting; they might also be used to start/stop other related equipments such as a raw water pump, a sampling pump, etc.

1.6 Analyser and detector

1.6.1 Analyser

1.6.1.1 Display on operator interface

Each analog input is displayed in engineering units.

1.6.1.2 Scaling

Each analog input is scaled in engineering units. The full-scale value must be set up on the operator interface to match the range of the instrument.

1.6.1.3 Out of range

The minimum and maximum range of an instrument is defined as the engineering value respectively associated to 4 mA and 20 mA signals. They stand for the limits of the operational scale of the instrument. All instruments mentioned in this document have a programmed "out of range" alarm. If signals exceed 20.5 mA or drop below 3.5 mA for over 60 seconds, an "out of range" alarm is detected and the instrument's reading is forced to 0. When an out of range alarm happens, all process alarms for the instrument are deactivated.

1.6.1.4 Analog alarm delay

The analog alarm delay is common to all process alarms and for all instruments. If for one instrument the delay is different from the common delay, it is specified in the instrument's section.

1.6.1.5 Process alarm

A process alarm is activated when the instrument's reading is over or under setpoint (determined by operator) and when the common analog alarm delay ran out.

Some instruments are programmed with HH, H and/or L, as well as LL alarms. The most common are HH (very high), H (high), L (low) and LL (very low). Process alarms are deactivated when corresponding transmitter is out of range. When an alarm has a different delay than the common analog alarm, it is specified with the description of the instrument's alarm.

1.6.1.6 Deviation alarm

A deviation alarm is activated when the instrument's reading deviates from the loop's setpoint ($\pm 10\%$) and the common analog alarm delay has elapsed. It is a useful alarm for an instrument whose reading is an automatic control value for a control loop in automated mode. Alarm activation condition: the control loop must be in auto mode.

1.6.1.7 Activation conditions for alarms

The activation conditions for process and deviation from setpoint alarms are particular to each instrument and depend on the process phase in which it is required, and its use. Normally, these conditions are common to all instrument process and deviation alarms. When an alarm requires activation conditions that are specified, these are noted along with the instrument's description.

1.6.1.8 Totalizer

For the specific case of a flowmeter, two totalizers are programmed to compute the water volume:

- one is dedicated to interface display;
- the other one is dedicated to reports.

They are reset to 0 at "99999999", whatever the unit value is. The one dedicated to display may be edited by the operator.

1.6.1.9 Calibration mode

The calibration mode allows the operator to establish the engineering value of the instrument at its last value, so the calibration of the instrument may be done without activating useless alarms.

When the instrument is in calibration mode the operator is able to modify the engineering value at the interface.

1.6.2 Detectors

1.6.2.1 General

Detectors emit a digital signal. A signal change of state produces an alarm and/or an action. A common alarm delay, adjustable or not, is always programmed to avoid false alarms. Detectors may be high level switches, low level switches, for chlorine leaks, intrusions, etc.

1.6.2.2 Digital alarm delay

The digital alarm delay is common to all detectors. If a detector's delay is different from common delay, it is specified in the instrument's section.

1.6.2.3 Security logic

When a detector's dry contact is used to trigger an alarm, it must be connected in a way that triggers the alarm when there is a circuit opening (power loss).

1.6.2.4 Activation conditions for alarms

Activation conditions for detector alarms are specific to each detector and depend on the process phases in which detectors are required, and their use. Normally, these conditions are common to all detector alarms.

When an alarm requires activation conditions that are specified, these are noted with the instrument's description.

1.7 Valves

1.7.1 Operational Mode

Interface manual mode:

A valve may operate in manual mode if the following conditions are met:

1. If manual mode is selected on interface
2. If the local selector or the override module is in "auto" position
3. If there is no detected fault (ALARM)
4. If the emergency stop is not activated

Auto mode:

A valve may operate in auto mode if the following conditions are met:

1. If automatic mode is selected on interface
2. If the local selector or the override module is in "auto" position
3. If there is no detected fault (ALARM)
4. If the emergency stop is not activated
5. If the automatic open/close conditions are met

1.7.2 Hand – Off – Auto Selectors

In some instances, valves may be operated manually with the help of a Hand-Off-Auto selector installed in one of the following way:

- At a local station installed near the equipment;
- On front of control panel;
- An override module installed in the control panel;

Only the emergency stop stays active on manual mode. In the case of pneumatic valves, this function is possible if valve air pressure is adequate.

Selector's position:

- Hand: the valve opens if there is no prevailing closing condition through wired logic.
- Off: valve closes.
- Auto: valve opens if the open control is activated from automation system, and if there is no closing condition by wired logic.

1.7.3 4 to 20 mA Modulator

Valves with pneumatic actuators or modulator type electric valves are equipped with a Hand-Off-Auto Selector and a 4 to 20 mA simulator (installed in panel) activating them and modulating the opening during control system failures. In the case of pneumatic valves, this function is possible if valve air pressure is adequate.

1.7.4 Valve alarm delay

For each valve alarm, a delay is always programmed as one of the alarm conditions. This delay is common to all valves unless otherwise indicated in valve's description.

1.7.5 Limit switch

In the case of a valve equipped with a limit switch connected to the automation system, the switch will be mentioned in the valve's description.

1.7.6 Open Fault Alarm

- For on/off actuator valves equipped with a limit switch in “On” position, if the opening control of the valve is active, but the open state confirmation isn’t and the alarm delay has elapsed, the open fault alarm is activated.
- For on/off actuator valves equipped with a limit switch in “Off” position, if the control of the valve is active but the close state confirmation isn’t and the alarm delay has elapsed, the open fault alarm is activated.
- For modulating actuator valves equipped with a limit switch in “Off” position, if the valve control is active at a degree above 20% but the close state confirmation isn’t and the alarm delay has elapsed, the open fault alarm is activated.
- For modulating actuator valves associated with a flowmeter, if flowmeter is not Out of range, if the opening control of the valve is active at a degree above 20% and the flow rate is below 5% of flowmeter’s range, the open fault alarm is activated.

1.7.7 Close Fault Alarm

- For on/off actuator valves equipped with a limit switch in “Off” position, if neither the valve’s opening control nor the close state confirmation is active, the close fault alarm is activated.
- For on/off actuator valves equipped with a limit switch in “On” position, if the valve’s opening control is not active, the open state confirmation is still active and the alarm delay has elapsed, the close state alarm is activated.
- For valves with modulating actuators equipped with a limit switch in “On” position, if the opening control of the valve is not active, the open state confirmation is still active and the alarm delay has elapsed, the close fault alarm is activated.
- For valves with modulating actuators equipped with a limit switch in “Off” position associated with a flowmeter, if flowmeter is not out of range, and if the opening control of the valve is not active and the flow rate is above 5% of flowmeter’s range, the close fault alarm is activated.

1.8 Typical Motor

1.8.1 Operational Mode

Interface manual mode:

A motor may operate in manual mode if the following conditions are met:

1. If manual mode is selected on interface
2. If local selector or override module is in Auto position
3. If no fault is detected (ALARM)
4. If the emergency stop is not activated

Auto mode:

A motor may operate in auto mode if the following conditions are met:

1. If auto mode is selected on interface
2. If local selector or override module is in Auto position
3. If no fault is detected (ALARM)
4. If the emergency stop is not activated
5. If auto start conditions are met

1.8.2 Hand-Off-Auto Selectors

In some cases, pumps and mixers may be manually operated with the help of a Manual-Off-Auto selector installed in one of three possible ways:

- A local station located near the equipment;
- A selector installed on front of control panel;
- An override module installed in control panel;

Only the emergency stop remains active on manual mode..

Selector position:

- Manual: motor is running if there are no stopping conditions through wired logic. For a VFD starter, speed is manually set on device
- Off: motor is stopped
- Auto: motor starts if start signal from automation system is activated and if there are no stop conditions through wired logic. For a VFD starter, speed is set either manually on device or by an analog signal output from the automation system.

1.8.3 Local disconnect switch

In some cases a local disconnect switch is a lockable device allowing the isolation of the motor to protect staff during maintenance. It is installed near the motor. It contains an auxiliary contact allowing the starter's control circuit opening.

Note: the disconnect switch must never be activated when motor is running. One has to stop motor before activating disconnect and deactivate disconnect before starting motor.

1.8.4 Wired logic stop

Regardless of selector's position and selected mode, wired logic stop conditions protect motor and force its stopping. These conditions, if relevant, are described in sections pertaining to the motor.

1.8.5 Motor alarm delay

For each motor alarm, a delay is always programmed. This delay is common to all motors unless otherwise indicated in motor's description.

1.8.6 Start fault alarm

If the motor starting control is activated but the running state confirmation isn't and the alarm delay ran out, the start fault alarm is activated. Operator must address the situation and reset fault to restart.

This alarm occurs with the presence of one of the following conditions:

- Activated overload relay ;
- Local selector or override module in Off position ;
- Local disconnect open ;

1.8.7 Running time

For each motor, two running time totalizers are programmed:

- The first one in hours and minutes (HHHHHHHH:MM) is dedicated to interface display
- The second, in minutes, is used for reports.

These totalizers are reset to zero at 99999999 and the one dedicated to display may be edited by operator on interface.

1.9 Metering Pump

1.9.1 Operational mode

Interface manual mode:

A metering pump may operate in manual mode if the following conditions are met:

1. If manual mode is selected on interface
2. If selector is in Auto position
3. If no fault is detected (ALARM)
4. If the emergency stop is not activated

Auto mode:

A metering pump may operate in auto mode if the following conditions are met:

1. If auto mode is selected on interface
2. If selector is in Auto position
3. If no fault is detected (ALARM)
4. If the emergency stop is not activated
5. If auto start conditions are met

1.9.2 Hand – Off– Auto Selectors

Metering pumps may be operated manually with the help of a Hand-Off-Auto selector installed as a local station or directly on the pump.

Selector position:

- Hand: pump is running; dosage concentration is manually selected on pump or on VFD if it is equipped with one.
- Off: pump is stopped
- Auto: pump starts if start control at automation unit is activated. Dosage concentration is controlled by an analog output signal from the automation unit.

1.9.3 Start Control

There are two types of start controls:

- Integrated to signal for dosage concentration, which is the most frequent case. The metering system starts if analog signal is above 4 mA, but stops if signal is below or equal to 4 mA. If there are no constraints from the automation system, the signal will be forced to 3,5 mA to ensure pump stopping.
- Start control separated by a digital signal: the closing of the normally open dry contact of a relay activated by a digital output of automation provides the start control of the metering pump. This digital signal is provided when the metering pump is equipped with a VFD requiring a local station.

1.9.4 Alarm

No alarm is programmed for metering pumps. A reaction on treatment may indicate a metering pump problem (pH, turbidity .)

1.9.5 Running Time

For each metering pump two running time totalizers are programmed:

- The first in hours and minutes (HHHHHHHH:MM) is dedicated to interface display
- The second in hours for reports.

These totalizers are reset to zero at "99999999"; the display totalizer may be edited at the interface.

1.10 Security Level

A different security level is configured in the control system. The various levels allow an access management of different data and setpoint change according to the various needs of the project.

Unless otherwise indicated, the following security levels are applied:

Security Level	Description
0	User may view all the project's pages, but no action is possible. (Default level)
1	User may start and stop equipments
2	User may change operational setpoints
3	User has access to password management (Administration level)

The second security level includes the 0 and 1 level. The third level includes the second, first and 0 levels, etc.

If the operator interface doesn't allow multiple security levels, a password is mandatory for all levels.

1.11 Emergency Stop

Emergency stop actions

When an emergency stop button is activated, an alarm is triggered. The fault associated with this alarm will latch.

During emergency stop, many stopping actions are initiated on equipments or process blocks. These actions are presented in sections describing the relevant equipments or process blocks.

Recovery after emergency stop

When all emergency stop buttons are back into normal position, the fault associated with an alarm is maintained until the operator proceeds to deactivate it.

1.12 Power Outage

1.12.1 Power outage

Upon power failure at the control panel, the “power failure mode” is activated. All automation unit outputs are deactivated by the single fact that automation has lost electrical power. Consequently, all equipments having selectors in Auto position become idle.

1.12.2 Power recovery

Upon power recovery and the detection of the automation unit first cycle, a start sequence is initialized before the restarting of various equipments.

1.12.2.1 Actiflo®

If Actiflo® units were running before the power outage, the following delays are applied before their restarting.

Delay #1: Starting of Priority Actiflo®

Delay #2: Starting of Non Priority Actiflo®

Note: If some selectors were in manual position before failure, the starting sequence will go on anyway but equipments in manual mode will restart simultaneously.

1.13 PID Loop

All PID loops are configured with an operator interface page to change the setpoint and parameters. The page includes the following values with their engineering units:

1.13.1 Accessible signals from the operator interface

Description	Format	Transfer direction	Pushbutton	Security Level
Auto/Manual Selection	Bool	Script	X	2
Manual Mode Loop	Bool	Reading		
Local/Distance Selection	Bool	Script	X	2
Distance Mode Loop	Bool	Reading		
Local Mode Setpoint	Real	Script		2
Distance Mode Setpoint	Real	Reading		
Processed Setpoint	Real	Reading		
Output Value	Real	Reading / Script		
Proportional	Real	Script		4
Integral	Real	Script		4
Derived	Real	Script		4

1.13.2 Operational Mode

Three operational modes are available:

- Manual Mode: Loop is not active; the output value is given manually by operator (Output Value).
- Local Auto Mode: Setpoint is given by operator (Setpoint in Local Mode)
- Distance Auto Mode: Setpoint is given by external source or a calculation, according to process

1.13.3 Volume compensated integral

Mainly used for pH and chlorine control loops, the VCI takes into account water flow and water volume between the dosing point and analyser. This calculation gives the necessary time for water to travel between the dosing point and analyser; it is constantly redone to reflect flow changes. The VCI may always be stopped, in which case the loop is only proportional to the flow.

1.14 Management of Alarms

1.14.1 Alarm Priorities

Alarms are grouped according to 2 priority levels for various attention requirements:

Alarms priority 1:

1. Needs immediate operator attention.
2. An equipment component may be stopped.

Alarms priority 2:

1. Does not need immediate operator attention.
2. May precede an alarm priority 1 (warning)

Alarm priorities are presented in the description of each alarm.

1.14.2 Distinguishing between alarm and fault

Alarm:

The alarm is a warning intended for the operator, who may acknowledge it at any moment with the use of the "Acknowledgement of alarms" button. When an alarm occurs, a message describing the alarm is displayed on the operator interface.

Fault:

The fault corresponds to the action generated by the alarm. So, for every fault, there is an associated alarm. The fault is maintained as long as the conditions that generated it remain active. Once the fault conditions are gone, the operator must reset the fault with the "fault reset button".

A "Reset to 0" button for fault timers allows the re-initialization of all faults, including the ones whose conditions remain active. When the condition creating the fault is always active, the alarm is triggered again once the fault delay has run out.

Note: if a fault associated with an equipment component is programmed so it corrects itself automatically, it will be specified in the section describing this equipment.

The common fault of an equipment component groups all faults pertaining to this equipment.

1.14.3 After an Alarm

When an alarm occurs:

1. A message appears on the HMI operator interface
2. The alarm pilot light blinks until there is acknowledgement by the operator
3. The operator must correct the situation and reset fault before restarting the system.

2 Operator Interface

2.1 Local Operator Interface

The operator interface provided with this system is an Allen-Bradley, PanelView Plus 600.

Interface allows the starting-up of the unit, stopping it, alarm acknowledgement, fault reset, initiation of an Actiflo® sequence, display and viewing of trends.

The setting of all adjustable delays inserted in the auto sequence is accessible at the operator's interface, but the access is limited. All data entries are limited in minimum and maximum to avoid faulty entries.

Local operator interface allows:

1. Access to different screens by a main menu.
2. Automatic/Manual mode selection for all valves and motors.
3. Open/Close or Start/Stop selection for manual operation of valves and motors.
4. Visualization of motor and valve status
5. Visualization and acknowledgement/reset of alarms (past and present)
6. Initialization of automatic start/stop Actiflo® sequence.
7. Visualization of analog measurements with engineering values or graphics.
8. Modification of ranges, setpoints and delays.

Pages are accessible with a valid password.

3 Raw Water

3.1 Analysers

3.1.1 Raw water turbidimeter

Tag: AIT1-011

Out of range raw water turbidimeter

Priority 2 alarm

Sequence of events when an alarm occurs:

1. The message " RAW WATER TURBIDIMETER EQUIPMENT FAULT ALARM" is displayed on interface;

High raw water turbidity

Priority 2 alarm

Sequence of events when an alarm occurs:

1. The message " RAW WATER TURBIDIMETER HIGH ALARM" is displayed on interface;

High High raw water turbidity

Priority 2 alarm

Sequence of events when an alarm occurs:

1. The message " RAW WATER TURBIDIMETER HIGH HIGH ALARM" is displayed on interface;

4 Actiflo®

4.1 Description

The coagulation/filtration process is based on two Actiflo® units.

All Actiflo® units may operate simultaneously without a backup unit.

Each Actiflo® unit has two recirculation pumps, one of which is backup (with permutation)

Unless otherwise indicated, the present chapter describes the operation of only one Actiflo® unit. Any description of an equipment or logic common to all units will be clearly identified.

4.2 Local control

4.2.1 Pushbuttons and pilot lights

Buttons and lights are installed on panel door.

The pilot lights identify prevailing operating conditions.

" Actiflo® #1 IN OPERATION" steady	The train is operating normally.
" Actiflo® #1 IN OPERATION" fast blinking	The train is in automatic start mode.
" Actiflo® #1 I N OPERATION" slow blinking	The train is in automatic stop mode.
" Actiflo® #1 IN OPERATION" off	The train is stopped.
" Actiflo® #2 IN OPERATION" steady	The train is operating normally.
" Actiflo® #2 IN OPERATION" fast blinking	The train is in automatic start mode.
" Actiflo® #2 I N OPERATION" slow blinking	The train is in automatic stop mode.
" Actiflo® #2 IN OPERATION" off	The train is stopped.

The push buttons are the following:

- Start/Stop Actiflo® #1
- Start/Stop Actiflo® #2

The "Start/Stop Actiflo® " installed on panel door or on operator interface allows the following actions:

- Activate/deactivate Auto mode
- Stop Actiflo

4.2.2 Pushbutton and pilot light colors

Pilot light:

- Running = Green
- Alarm = Red

Pushbutton and selector:

- Start/Stop = Green
- Other function = Black
- Selector = Black

4.2.3 Transmitted signals (to others)

A local station (Manual/Off/Auto) is installed near each recirculation pump. All mixers are equipped with an override module installed in the PLC panel.

4.2.4 Transmitted signals (to others)

The following "hardwire" signals are available from the Actiflo® system panel:

- Dry contact status of Actiflo® #1
- Dry contact status of Actiflo® #2
- Common general alarm

These standard signals may be used during commissioning and/or troubleshooting. They can also be used to start other related equipments such as raw water pumps, sampling pumps, etc.

4.2.5 Signals to be received (from others)

Here are the "hardwire" signals received at the control panel:

- Remote control command « START/STOP AUTOMATIC SEQUENCE » of Actiflo® #1
- Remote control command « START/STOP AUTOMATIC SEQUENCE » of Actiflo® #2

These standard signals may be used during commissioning and/or troubleshooting. Once stopped, the Actiflo® start sequence is initialized if Actiflo® is in Auto mode; if this contact is not used, a "jumper" must be installed.

4.3 Automatism / Auto Mode

4.3.1 Auto Mode

The Auto mode being originally deactivated, the Actiflo® unit runs in Auto mode by pushing the Start/Stop on panel door or at operator interface, if the following conditions are met:

1. Conditions for auto start sequence
2. No conditions for auto stop sequence

Upon the activation of the Actiflo® automatic start sequence an alarm will be displayed if equipment is not in Auto mode. This alarm indirectly lets you know that some equipment is in manual running or stop mode ("EQUIPMENT ON MANUAL MODE" message).

When the Actiflo® unit is in Auto mode, it can be deactivated by one of the following conditions:

1. Pushing the Start/Stop button on panel door or at operator interface for a second time
2. Actiflo® unit has major fault
3. Activation conditions for the auto stop sequence are present.

If Auto mode is deactivated by a major fault or by stop conditions, the Actiflo® unit can't be put back in Auto mode unless operator addresses the situation, corrects the faults and hits the Stop/Auto button again.

4.3.2 Activation conditions for auto start sequence

When operator pushes Start/Stop button (on panel or at operator interface) the start sequence is activated if following conditions are met:

If delay, when power is back after outage, has expired.

Other conditions:

1. Injection mixer in auto
2. Maturation mixer in auto
3. Scraper in auto
4. At least one recirculation pump in auto
5. Raw water valve in auto
6. No major fault is present

4.3.3 Activation conditions for auto stop sequence

The stop sequence is activated when one of the following conditions is the case:

1. Operator pushes Start/Stop button (on panel or at interface)
2. The remote start's dry contact is deactivated
3. When a major fault is activated

If Actiflo® is stopped by a major fault, it won't restart unless the operator addresses the situation, corrects the faults and hits start button again.

4.3.4 Major faults

List of faults causing Actiflo® stop:

1. Faulty injection mixer
2. Faulty maturation mixer
3. Faulty scraper
4. Both recirculation pump in fault
5. Faulty raw water valve
6. High high clarified water turbidity
7. Low raw water flow
8. High high level Actiflo® switch is activated
9. Emergency stop is activated

4.3.5 Alarm deactivation delay after start of Actiflo® unit

In order to avoid false process alarms following the start of an Actiflo® unit, the operator can set a process alarm deactivation delay at the interface (0 to 60 min.) after the start of an Actiflo®. During this time, all corresponding Actiflo® process alarms, such as turbidity, pH, etc., are deactivated. However, level and flow alarms do remain active.

4.3.6 No alarm mode

The mode without alarm allows the operator to deactivate the process alarms of the corresponding Actiflo® for a non-adjustable, 60-minute period. It is mostly used after treatment loss. Rather than modifying each and every process alarm setpoint, the operator activates this mode so he may focus on treatment recovery. Oversights and mistaken handling of alarm setpoints are thus less likely. As a security feature, this mode is automatically deactivated after 60 minutes. It may be activated or deactivated at any time from the operator interface. Level and flow alarms remain unaffected by this mode.

4.3.7 Actiflo® priority

Both Actiflo® will be following the service water pump priority. The Actiflo® need to be in operation for the associated service water pump to run.

If Actiflo® with the pump priority 1 goes in major fault and is stopped, the priority is swapped to the other pump and the other Actiflo®. Also, the pH meter used for the caustic loop is associated with the pump and Actiflo® that are priority 1.

4.3.8 Actiflo® start sequence

Once the auto start sequence is initiated, the Actiflo® unit starts according to the following sequence:

Step #	Step Name	Actions Step Change Condition	Recirculation Pump	Coagulation Mixer	Injection Mixer	Maturation Mixer	Scraper	Operational Status	Status Light
0	Full Stop	Equipments not running Operational status: deactivated	S	S	S	S	S	D	C
		Initiation of auto start sequence							
1	Start Sequence	Recirculation pump start	R	S	S	S	S	D	RB
		Elapsed time (sequence delay specific to motor)							
2	Start Sequence	Scraper start	R	S	S	S	R	D	RB
		Elapsed time (sequence delay specific to motor)							
3	Start Sequence	Coagulation mixer start	R	R	S	S	R	D	RB
		Elapsed time (sequence delay specific to motor)							
4	Start Sequence	Injection mixer start	R	R	R	S	R	D	RB
		Elapsed time (sequence delay specific to motor)							
5	Start Sequence	Maturation mixer start Activation of running status	R	R	R	R	R	AC	O
		Elapsed time (sequence delay specific to motor)							
6	Actiflo® operating	Actiflo® operating	R	R	R	R	R	AC	O

Legend

Motor

S : Stop
R : Running

Valve

C : Closed
O : Open

Status

AC : Active
D : Deactivated

Light

C : Closed
O : Open
RB : Rapid blink
SB : Slow blink

4.3.9 Actiflo® stop sequence

Once the automatic stop sequence has been initiated, the Actiflo® unit stops according to the following sequence:

Step #	Step Name	Actions Step Change Condition	Recirculation Pump	Coagulation Mixer	Injection Mixer	Maturation Mixer	Scraper	Operational Status	Status Light
		Initiation of auto stop sequence							
7	Stop Sequence	Coagulation mixer stop; Injection mixer stop; Maturation mixer stop; Deactivation of running status	R	S	S	S	R	D	SB
		Elapsed time (stop sequence delay specific to scraper)							
8	Stop Sequence	Scraper stop / No action	R	S	S	S	S	D	SB
		Elapsed time (stop sequence delay specific to recirculation pump)							
9	Stop Sequence	Recirculation pump stop	S	S	S	S	S	D	SB
		Elapsed time (1 sec.)							

Legend

Motor

S : Stop
R : Running

Valve

C : Closed
O : Open

Status

AC : Active
D : Deactivated

Light

C : Closed
O : Open
RB : Rapid blink
SB : Slow blink

4.3.10 Recirculation pump logic

The recirculation pump must be running for Actiflo® operation.

Two pumps are installed for each Actiflo® unit.

When both pumps are faulty, the Actiflo® unit stops due to a major fault.

If one pump is faulty and the Actiflo® unit is running, the second pump will start. The Actiflo® unit won't stop, an alarm will be displayed and a priority 2 fault will be activated. If the second pump should also become faulty or if it's in manual mode, the Actiflo® unit will stop.

Operator may select one of the two pumps as priority or run both at the same time, with the help of a pushbutton on interface.

4.4 Pumps and Mixers

4.4.1 Coagulation mixer

One mixer per Actiflo®

Tag: M2-011, M2-021

Automatic mode

Mixer operates:

1. If sequencer is on step 3, 4, 5 or 6.
2. If E-stop is not activated.

Coagulation mixer fault alarm

Priority 2 alarm

Sequence of events when alarm is triggered:

1. Mixer stops
2. The "ACTIFLO #x COAGULATION MIXER EQUIPMENT FAULT ALARM" message is displayed on operator interface

4.4.2 Injection mixer

One mixer per Actiflo®

Tag: M2-012, M2-022

Automatic mode

Mixer operates:

1. If sequencer is on step 4, 5 or 6.
2. If E-stop is not activated.

Injection mixer fault

Priority 1 alarm

Sequence of events when alarm is triggered:

1. Mixer stops
2. The "ACTIFLO #x INJECTION MIXER EQUIPMENT FAULT ALARM" message is displayed on the operator interface
3. The corresponding Actiflo® unit stops according to the automatic stop sequence.

4.4.3 Maturation mixer

One mixer per Actiflo®
Tag: M2-013, M2-023

The maturation mixer speed is directly adjusted on the VFD during system start-up in order to obtain an optimal blend. Once the speed is adjusted, it is stable.

Auto mode

Mixer operates:

1. If sequencer is on step 5 or 6.
2. If E-stop is not activated.

Interlock:

The associated recirculation pump must be running to allow mixer operation.
Interlock is active in auto mode and manual mode.

Maturation mixer fault

Priority 1 alarm

Sequence of events when an alarm occurs:

1. Mixer stops
2. The "ACTIFLO #x MATURATION MIXER EQUIPMENT FAULT ALARM" message is displayed on the operator interface
3. The corresponding Actiflo® unit stops according to the automatic stop sequence.

4.4.4 Recirculation pump

Tag: P2-011, P2-012, P2-021, P2-022

Automatic mode

Pump is operational:

1. If sequencer is on step 2 to 8.
2. If E-stop is not activated.

Recirculation pump fault

Priority 1 alarm

Sequence of events when an alarm occurs:

1. Pump stops
2. The "ACTIFLO #x RECIRCULATION PUMP #x EQUIPMENT FAULT ALARM" message is displayed on the operator interface
3. Refer to section "Automatism / Recirculation pump logic"

4.4.5 Scraper

Tag: S2-011, S2-021

Automatic mode

Scraper is operational:

1. If sequencer is on step 2 to 6
2. If E-stop is not activated

Interlock:

The associated recirculation pump must be running to allow scraper action.

Interlock active in automatic or interface manual mode.

Scraper fault

Priority 1 alarm

Sequence of events when alarm occurs:

1. Scraper stops
2. The "ACTIFLO #x SCRAPER EQUIPMENT FAULT ALARM " message is displayed on the operator interface
3. The corresponding Actiflo® unit stops according to the automatic stop sequence.

4.5 Valves

4.5.1 Raw water valve

One raw water valve per Actiflo® unit
Tag: V2-011, V2-021

The raw water valve is a modulating valve. It is controlled by a PID loop whose setpoint is determined by the operator.

Automatic mode

1. If sequencer is on step 5 or 6
2. If E-stop is not activated.

The valve doesn't have status contact. The fault is programmed with a disparity of the flowmeter reading.

Raw water valve open fault

Priority 1 alarm

Sequence of events when an alarm occurs:

1. Valve opening adjusted to 0%
2. The "OPEN FAULT RAW WATER VALVE ACTIFLO® #x " message is displayed on the operator interface;
3. The corresponding Actiflo® unit stops according to the automatic stop sequence

Raw water valve close fault

Priority 1 alarm

Sequence of events when an alarm occurs:

1. Valve opening adjusted to 0%
2. The " ACTIFLO #x RAW WATER VALVE FAIL TO CLOSE ALARM" message is displayed on the operator interface
3. The corresponding Actiflo® unit stops according to the automatic stop sequence

Raw water valve open fault

Priority 1 alarm

Sequence of events when an alarm occurs:

1. Valve opening adjusted to 100%
2. The " ACTIFLO #x RAW WATER VALVE FAIL TO OPEN ALARM" message is displayed on the operator interface
3. The corresponding Actiflo® unit stops according to the automatic stop sequence

4.6 Analysers

4.6.1 Raw water flowmeter

One raw water flowmeter per Actiflo® unit
Tag: FIT2-011, FIT2-021
Unit: m³/h

Out of range raw water flowmeter alarm

Priority 1 alarm

Sequence of events when alarm occurs:

1. The message " ACTIFLO #x RAW WATER FLOWMETER EQUIPMENT FAULT ALARM" is displayed on the operator interface
2. The corresponding Actiflo® unit stops according to the automatic stop sequence

Actiflo® unit may be operated manually if raw water flow rate is known and stable and if chemical dosage is manually adjusted.

Low low raw water flow alarm

Priority 1 alarm

Sequence of events when an alarm occurs:

1. The message " ACTIFLO #x RAW WATER FLOWMETER LOW LOW ALARM" is displayed on the operator interface
2. The corresponding Actiflo® unit stops according to the automatic stop sequence

Activation condition for this alarm: raw water valve V2-011 for Actiflo® 1 or V2-012 for Actiflo® 2 valve more than 10% open.

Low raw water flow alarm

Priority 2 alarm

Sequence of events when an alarm occurs:

1. The message " ACTIFLO #x RAW WATER FLOWMETER LOW ALARM" is displayed on the operator interface

Activation condition for this alarm: raw water valve V2-011 for Actiflo® 1 or V2-012 for Actiflo® 2 valve more than 10% open.

High raw water flow alarm

Priority 2 alarm

Sequence of events when an alarm occurs:

1. The message " ACTIFLO #x RAW WATER FLOWMETER HIGH HIGH ALARM" is displayed on the operator interface

High high raw water flow alarm

Priority 2 alarm

Sequence of events when an alarm occurs:

1. The message "HIGH ACTIFLO #x RAW WATER FLOWMETER HIGH ALARM " is displayed on the operator interface

Generally, the high high and low low flow thresholds respectively correspond to the hydraulic capacity, and 10% of the Actiflo® unit hydraulic capacity.

Raw water flow deviation alarm

Priority 2 alarm

Sequence of events when an alarm occurs:

1. The message " ACTIFLO #x RAW WATER FLOWMETER FLOW DEVIATION ALARM" is displayed on the operator interface

4.6.2 Coagulation pH

One pH-meter per Actiflo® unit

Tag: pHIT2-011, pHIT2-021

Unit: pH

Process alarms can only be triggered when all the following activation conditions are met:

1. Actiflo® unit is running
2. Deactivation time of process alarms after Actiflo® start has elapsed
3. The no alarm mode is deactivated for the Actiflo® unit.

Out of range coagulation pH-meter alarm

Priority 2 alarm

Sequence of events when an alarm occurs:

1. The message " ACTIFLO #x CLARIFIED WATER PH METER EQUIPMENT FAULT ALARM" is displayed on operator interface
2. The operation mode changes from VCI to proportional to the flow.

Low low coagulation pH alarm

Priority 1 alarm

Sequence of events when an alarm occurs:

1. The message " ACTIFLO #x CLARIFIED WATER PH METER LOW LOW ALARM" is displayed on operator interface

Low coagulation pH alarm

Priority 2 alarm

Sequence of events when an alarm occurs:

1. The message " ACTIFLO #x CLARIFIED WATER PH METER LOW ALARM" is displayed on operator interface

High coagulation pH alarm

Priority 2 alarm

Sequence of events when an alarm occurs:

1. The message " ACTIFLO #x CLARIFIED WATER PH METER HIGH ALARM " is displayed on operator interface

High high coagulation pH alarm

Priority 1 alarm

Sequence of events when an alarm occurs:

1. The message " ACTIFLO #x CLARIFIED WATER PH METER HIGH HIGH ALARM" is displayed on operator interface

4.6.3 Clarified water turbidimeter

One clarified water turbidimeter per Actiflo® units

Tag: AIT2-011, AIT2-022

Unit: NTU

Process alarms can be triggered only when all the following activation conditions are met:

1. Actiflo® unit is running
2. Deactivation time of process alarms after Actiflo® start has elapsed
3. The no alarm mode is deactivated for the Actiflo® unit

Out of range clarified water turbidimeter

Priority 2 alarm

Sequence of events when an alarm occurs:

1. The message " ACTIFLO #x CLARIFIED WATER TURBIDIMETER EQUIPMENT FAULT ALARM" is displayed on operator interface

High clarified water turbidity alarm

Priority 2 alarm

Sequence of events when an alarm occurs:

1. The message " ACTIFLO #x CLARIFIED WATER TURBIDIMETER HIGH ALARM" is displayed on operator interface

High high clarified water turbidity alarm

Priority 1 alarm

Sequence of events when an alarm occurs:

1. The message " ACTIFLO #x CLARIFIED WATER TURBIDIMETER HIGH HIGH ALARM" is displayed on operator interface
2. A separate timer is started before the corresponding Actiflo® is stopped. This timer is set on the HMI

4.6.4 Actiflo® high high level switch

One switch per Actiflo® unit

Tag : LSHH2-011, LSHH2-021

High high level alarm

Priority 1 alarm

Sequence of events when an alarm occurs:

1. The message " ACTIFLO #x HIGH HIGH WATER LEVEL ALARM" is displayed on operator interface
2. The corresponding Actiflo® unit stops according to the automatic stop sequence

4.6.5 Scraper torque detector

Tag: WT2-011, WT2-021

The torque detector/alarm is independent from the PLC. It is available when scraper is started from a local station or an override module.

High scraper torque

Priority 2 alarm

A high torque alarm is activated when the torque is higher than the adjustable setpoint for more than the adjustable delay. Those adjustable variables are set in the programmable relay (HPL220) installed in the panel.

Sequence of events when an alarm occurs:

1. The message " ACTIFLO #X SCRAPER HIGH TORQUE ALARM" is displayed on operator interface

High high scraper torque

Priority 1 alarm

A high high torque alarm is activated when torque is higher than the adjustable setpoint for more than the adjustable delay. Those adjustable variables are set in the programmable relay (HPL220) installed in the panel.

Sequence of events when an alarm occurs:

1. Scraper stops
2. The message " ACTIFLO #X SCRAPER HIGH HIGH TORQUE ALARM" is displayed on operator interface
3. The corresponding Actiflo® unit stops according to the automatic stop sequence

For cases when the PLC is faulty or when scraper is operated manually, the high high scraper torque alarm will stop scraper. No message will be displayed if PLC is defective. The reset of the programmable relay (HPL220) is done through the PLC or with the fault reset button on panel door.

If programmable relay is faulty, scraper will stop.

5 CHEMICAL DOSING

5.1 Coagulant

5.1.1 Coagulant dosing

Tag: P9-511, P9-512, P9-513

Coagulant is proportionally dosed to the total raw water flow. The dosing point is before each of the Actiflo® unit. Three pumps are installed for coagulant dosing. The pump P9-511 is designed to operate for the Actiflo® 1 and P9-513 for the Actiflo® 2. The pump P9-512 is the backup. Operator must change the positions of some manual valves and locally put the pump in auto to use backup.

Coagulant dosing is calculated with the aid of this formula:

$$Q_{coag} = \frac{Q \times SP}{C \times SG \times 10}$$

Qcoag. : Chosen coagulant dosage (L/h)
Q: Raw water flow Actiflo (m³/h)
SP: Dosage setpoint (mg/L)
SG: Density (Kg/L)
C: Concentration (%) (Example: 48%)

Formula below gives reference speed for metering pumps, in percentage. A pump calibration must be done in order to get a linear speed curve, depending on pump capacity.

$$V_{pump} = 20 + \left[\left(\frac{60}{Q_{80} - Q_{20}} \right) * (Q_{coag} - Q_{20}) \right]$$

Vpump: Pump reference speed;
Qcoag: Dosage (calculated in previous equation) (L/h);
Q20: Dosage flow measured at 20% of pump speed (L/h);
Q8: Dosage flow measured at 80% of pump speed (L/h);

Auto mode

Pump operates if:

1. Maturation mixer works;
2. Coagulant dosing tank is not empty
3. E-stop is not activated.

High temperature

Priority 2 alarm

Sequence of events:

1. The message " COAGULANT DOSING PUMP #X TEMPERATURE ALARM, RESET FAUT AT THE PANEL" is displayed on operator interface;
2. The pump is deactivated

Maximum coagulant flow alarm

Priority 2 alarm

Sequence of events:

1. The message "COAGULANT DOSING PUMP #X HIGH DOSING CAPACITY ALARM, STROKE MUST BE ADJUSTED, REQUIRED DOSAGE CAN'T BE REACHED " is displayed on operator interface;

Minimum coagulant flow alarm

Priority 2 alarm

Sequence of events:

1. The message "COAGULANT DOSING PUMP #X LOW DOSING CAPACITY ALARM, STROKE MUST BE ADJUSTED, REQUIRED DOSAGE CAN'T BE REACHED " is displayed on operator interface;

Coagulant preparation system

The coagulant preparation system consists of two tanks of 1000L. The first one prepares the batch and when done, transfers to the second tank for dosing.

5.1.1.1 Preparation system sequence

Step #	Step Name	Actions Transition conditions	Preparation Water Valve	Coagulant dry feeder	Preparation mixer	Preparation transfer Pump
0	Waiting Time	Preparation system ready Waiting for preparation request	C	S	S	S
		Low level maturation tank AND No low solid level, dry feeder alarm, mixer alarm, transfer pump alarm or level-meter alarm.				
1	Water filling	Open preparation water valve Initial preparation water level reach	O	S	S	S
2	Coagulant feeding start	Start coagulant dry feeder Minimum mixer level reach OR elapsed feeding time	O	R	S	S
3	Feeding and preparation	Start preparation mixer Elapsed feeding time OR full level preparation tank	O	R	R	S
4	Coagulant feeding stop	Stop coagulant dry feeder Full level preparation tank	O	S	R	S
5	Maturation	Close preparation water valve Start of maturation period Elapsed time (Maturation time)	C	S	R	S
6	Coagulant transfer waiting time	Stop preparation mixer Solution ready Empty level dosing tank	C	S	S	S
7	Coagulant transfer	Start transfer pump Empty level maturation tank	C	S	S	R
8	Coagulant transfer end	Stop transfer pump	C	S	S	S

Legend

Motor

S : Stop
R : Running

Valve

C : Closed
O : Open

Parameter	Default value
Low level maturation tank (L)	50
Initial preparation water level (L)	100
Minimum mixer level (L)	250
Full level preparation (L)	950
Feeding time (min)	10
Maturation time (min)	20

5.1.1.2 Pumps, mixers and motors

Preparation mixer

Tag: M9-511

Automatic mode

Mixer operates:

1. If sequencer is on step 3, 4 or 5
2. If E-stop is not activated.

Coagulant mixer fault alarm

Priority 2 alarm

Sequence of events when alarm is triggered:

1. Mixer stops
2. The "COAGULANT MIXER EQUIPMENT FAULT ALARM " message is displayed on operator interface
3. Stop preparation sequence

Transfer pump

Tag: P9-515

Automatic mode

Pump operates:

1. If sequencer is on step 7;
2. If E-stop is not activated;
3. If full level from dosing tank is not activated;
4. If empty level from maturation tank is not activated;

Transfer pump fault alarm

Priority 2 alarm

Sequence of events when alarm is triggered:

1. Pump stops
2. The "COAGULANT TRANSFER PUMP EQUIPMENT FAULT ALARM " message is displayed on operator interface
3. Complete present sequence without transfer, next sequence will not start.

Blower

Tag: B9-513

Automatic mode

Mixer operates for a configurable time:

1. If the unload bag button is activated

Coagulant blower fault alarm

Priority 2 alarm

Sequence of events when alarm is triggered:

1. The "COAGULANT BLOWER EQUIPMENT FAULT ALARM " message is displayed on operator interface

Dry feeder

Tag: DF9-511

Automatic mode

Dry feeder operates:

1. If sequencer is on step 2 or 3
2. If E-stop is not activated.

Dry feeder fault alarm

Priority 2 alarm

Sequence of events when alarm is triggered:

1. Dry feeder stops
2. The "COAGULANT DRY FEEDER EQUIPMENT FAULT ALARM " message is displayed on operator interface
3. Stop the sequence

5.1.1.3 Valve

Preparation water valve

Tag: V9-518

Automatic mode

1. If sequencer is on step 1 to 4
2. If E-stop is not activated.

The valve doesn't have status contact. The open fault is activated after a request to open and without change in the water level after a defined time.

Preparation water valve open fault

Priority 2 alarm

Sequence of events when an alarm occurs:

1. The valve is deactivated
2. The "COAGULANT WATER VALVE FAIL TO OPEN ALARM " message is displayed on the operator interface;
3. Stop the sequence

5.1.1.4 Analysers

Maturation tank level meter

Tag: LIT9-511

Out of range level-meter

Priority 2 alarm

Sequence of events:

1. The message "COAGULANT MATURATION LEVEL TRANSMITTER EQUIPMENT FAULT ALARM " is displayed on operator interface ;
2. Stop the sequence

Low low level

Priority 1 alarm

Sequence of events:

1. The message "COAGULANT MATURATION LEVEL TRANSMITTER LOW LOW ALARM " is displayed on operator interface;
2. Stop the transfer pump

Low level

Priority 2 alarm

Sequence of events:

1. The message "COAGULANT MATURATION LEVEL TRANSMITTER LOW ALARM" is displayed on operator interface;

High level alarm

Priority 2 alarm

1. The message "COAGULANT MATURATION LEVEL TRANSMITTER HIGH ALARM " is displayed on operator interface.

High high level alarm

Priority 1 alarm

1. The message "COAGULANT MATURATION LEVEL TRANSMITTER HIGH HIGH ALARM " is displayed on operator interface.
2. Close the water valve

Dosing tank level meter

Tag: LIT9-512

Out of range level-meter

Priority 1 alarm

Sequence of events:

1. The message " COAGULANT DOSING TANK LEVEL TRANSMITTER EQUIPMENT FAULT ALARM " is displayed on operator interface ;
2. Stop the transfer

Low low level

Priority 1 alarm

Sequence of events:

1. Coagulant pump stops
2. the message "COAGULANT DOSING TANK LEVEL TRANSMITTER LOW LOW ALARM " is displayed on operator interface;
3. The "ALARM" pilot light goes on.
4. The Actiflo® units stop according to auto stop sequence.

Low level

Priority 2 alarm

Sequence of events:

1. The message "COAGULANT DOSING TANK LEVEL TRANSMITTER LOW ALARM " is displayed on operator interface;

High level alarm

Priority 2 alarm

1. The message "COAGULANT DOSING TANK LEVEL TRANSMITTER HIGH ALARM " is displayed on operator interface.

High high level alarm

Priority 2 alarm

1. The message "COAGULANT DOSING TANK LEVEL TRANSMITTER HIGH HIGH ALARM " is displayed on operator interface.
2. Stop the transfer pump

Low solid coagulant level

Tag: LSL9-513

Low level

Priority 2 alarm

Sequence of events:

1. The message "COAGULANT POWDER LOW LEVEL ALARM " is displayed on operator interface;
2. Dry feeder stop;
3. Stop the sequence.

5.2 Polymer

5.2.1 Polymer dosage

Tag: P9-521, P9-522, P9-523

Polymer is proportionally dosed to the total raw water flow. The dosing point is before each of the Actiflo® unit. Three pumps are installed for polymer dosing. The pump P9-521 is designed to operate for the Actiflo® 1 and P9-523 for the Actiflo® 2. The pump P9-522 is the backup. Operator must change the positions of some manual valves and locally put the pump in auto to use backup.

Polymer dosing calculations

Polymer dosing is calculated with the use of this formula:

$$Q_{poly} = \frac{Q \times SP}{C}$$

Q_{poly}: Chosen polymer dosage (L/h)

Q: Actiflo raw water flow (m³/h)

SP: Dosage setpoint (mg/L)

C: Concentration (g/L)

The formula below determines the reference speed for metering pumps, in percentage. Calibration of pumps must be done in order to get a linear reference speed curve, on the basis of the pump's capacity.

$$V_{pump} = 20 + \left[\left(\frac{60}{Q_{80} - Q_{20}} \right) * (Q_{poly} - Q_{20}) \right]$$

V_{pump}: Pump's reference speed;

Q_{poly}: Dosage (calculated in previous equation) (L/h) ;

Q₂₀: Dosage flow measured at 20% of pump speed (L/h);

Q₈₀: Dosage flow measured at 80% of pump speed (L/h);

The SP, Q₂₀, Q₈₀ and C variables are entered at operator interface.

Automatic mode

Pump will operate if:

1. The maturation mixer is running.
2. E-stop is not activated.

High temperature

Priority 2 alarm

Sequence of events:

1. The message "POLYMER DOSING PUMP #x TEMPERATURE ALARM, RESET FAUT AT THE PANEL " is displayed on operator interface;
2. The pump is deactivated

Maximum polymer flow alarm

Priority 2 alarm

Sequence of events:

1. The message "POLYMER DOSING PUMP #x HIGH DOSING CAPACITY ALARM, STROKE MUST BE ADJUSTED, REQUIRED DOSAGE CAN'T BE REACHED" is displayed on operator interface ;

Minimum polymer flow alarm

Priority 2 alarm

Sequence of events:

1. The message "POLYMER DOSING PUMP #x LOW DOSING CAPACITY ALARM, STROKE MUST BE ADJUSTED, REQUIRED DOSAGE CAN'T BE REACHED" is displayed on operator interface.

5.2.2 Water transport valve, polymer

Tag: V9-521, V9-522

One valve per Actiflo®

The solenoid transport valve helps the polymer to reach the Actiflo® unit. The V9-521 is dosing the Actiflo® 1 and the V9-522 is dosing the Actiflo® 2.

Automatic mode

Valve will open if:

1. The maturation mixer is running.
2. E-stop is not activated.

5.2.3 TOMAL Automatic polymer preparation system

Tag: JB9-521

The automatic preparation system is independent from the Actiflo® PLC. It is controlled by a relay panel of which a few signals are transferred to the PLC.

General alarm

Priority 2 alarm

Sequence of events:

1. The message "POLYMER PREPARATION SYSTEM MIXER FEEDER OVERLOAD ALARM " is displayed on operator interface;

Low level dosage tank alarm

Priority 1 alarm

Sequence of events:

1. Pumps stop
2. The message "POLYMER PREPARATION SYSTEM LOW POLYMER LEVEL ALARM " is displayed on operator interface;
3. Both Actiflo® units stop according to the automatic stop sequence.

Low water pressure alarm

Priority 2 alarm

Sequence of events:

1. The message "POLYMER PREPARATION SYSTEM LOW WATER PRESSURE ALARM " is displayed on operator interface;

Low powder level alarm

Priority 2 alarm

Sequence of events:

1. The message "POLYMER PREPARATION SYSTEM LOW POWDER LEVEL ALARM " is displayed on operator interface ;

5.3 Caustic soda (NaOH)

5.3.1 Caustic Soda dosage

Tag: P9-541, P9-542, P9-543

Caustic soda is proportionally dosed to the total raw water flow with a volume compensated integral control loop. The dosing point is before each of the Actiflo® unit. Three pumps are installed for caustic soda dosing. The pump P9-541 is designed to operate for the Actiflo® 1 and P9-543 for the Actiflo® 2. The pump P9-542 is the backup. Operator must change the positions of some manual valves and locally put the pump in auto to use backup.

Automatic mode

Pump operates if:

1. Maturation mixer works;
2. E-stop is not activated.

High temperature

Priority 2 alarm

Sequence of events:

1. The message "NAOH DOSING PUMP #x TEMPERATURE ALARM, RESET FAUT AT THE PANEL " is displayed on operator interface;
2. The pump is deactivated

Maximum Caustic soda flow alarm

Priority 2 alarm

Sequence of events:

1. The message "NAOH DOSING PUMP #x HIGH DOSING CAPACITY ALARM, STROKE MUST BE ADJUSTED, REQUIRED DOSAGE CAN'T BE REACHED " is displayed on operator interface ;

Minimum Caustic soda flow alarm

Priority 2 alarm

Sequence of events:

1. The message "NAOH DOSING PUMP #x LOW DOSING CAPACITY ALARM, STROKE MUST BE ADJUSTED, REQUIRED DOSAGE CAN'T BE REACHED " is displayed on operator interface;

Caustic Soda dosing calculations

Caustic Soda flow in L/h:

$$Q_{sd} = \frac{Q \times SP}{C \times SG \times 10}$$

Qsd: Chosen caustic soda dosage (L/h)
Q: Actiflo raw water flow (m³/h)
SP: Dosage setpoint (mg/L)
SG: Density (Kg/L) = 1kg/L for water
C: Concentration (%) (Example: 48%)

The formula below gives the reference speed for metering pumps, in percentage. Calibration of pumps must be done in order to get a linear reference speed curve, on the basis of the pump's capacity.

$$V_{pump} = 20 + \left[\left(\frac{60}{Q_{80} - Q_{20}} \right) * (Q_{sd} - Q_{20}) \right]$$

Vpump: Pump's reference speed;
Qsd: Dosage (calculated in previous equation) (L/h);
Q20: Dosage flow measured at 20% of pump's speed (L/h);
Q80: Dosage flow measured at 80% of pump's speed (L/h);

Note: if pump's stroke is changed, flow values at 20% and 80% are changed on operator interface.

5.3.2 Mixer

Preparation mixer

Tag: M9-541

Automatic mode

Mixer operates for a configurable time:

1. If the HMI button change to auto.

Caustic soda mixer fault alarm

Priority 2 alarm

Sequence of events when alarm is triggered:

1. Mixer stops
2. The "NAOH MIXER EQUIPMENT FAULT ALARM " message is displayed on operator interface

6 SERVICE WATER

6.1 Pumps

Tag: P7-011, P7-012

The service water pump supply is at each corresponding Actiflo®. One pump will run at a time. The pump priority is set at the HMI. The pump priority will set the Actiflo® priority as well.

The pump priority will be automatically change if:

1. The associated Actiflo® is in major fault
2. The priority pump is in fault
3. The Actiflo® is stoped by the operator with the HMI or the button.

Automatic mode

Pump is operational:

1. If the corresponding Actiflo® is in operation;
2. If, for the backup pump, the primary pump is not running;
3. If E-stop is not activated.

Service water pump fault

Priority 1 alarm

Sequence of events when an alarm occurs:

1. Pump stops
2. The "SERVICE WATER PUMP #x FAULT ALARM " message is displayed on the operator interface
3. Swap the pump priority
4. Start the backup pump

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INPUT / OUPUT LIST

LEFT BLANK



ENVITECH AUTOMATION INC.
180 BRUNSWICK,
POINTE-CLAIRE, QC H9R 5P9

QTY TO PRODUCE ON WORK ORDER (1)

CUSTOMER BILL OF MATERIEL
NC01, MEADOWBANK - A4765A, LOT: 2

#	DESCRIPTOR	QTY REQ. UNIT	MANUFACTURER	MANUFACTURER PART #	DESCRIPTION
CONTROL PANEL (QTY: 1)					
10	ENCLOSURE	1.000	HAMMOND	1422F16F	PANEL NEMA 12, 72HX72WX16D C/W BACKPLATE
20	FILTER	1.000	RITTAL	SK 3323.207	EXHAUST FILTER FOR FAN SK 3151/66. (204M
30	FAN	1.000	RITTAL	SK 3323.117	FAN115V, 70CFM
50	ENCLOSURE LIGHT	1.000	LITHONIA	S120120LPF (UL)	24" NEON FIXTURE, SUPPLY 120VAC, 1 TUBE,
60	ENCLOSURE LIGHT	1.000	PHILIPS	F20T12CW	FLUORESCENT TUBE 24"
70	ENCLOSURE LIGHT	0.500	ELECTRA	ELETG40C	PLASTIC TUBE CLEAR 48" NEON PROTECTION
80	ENCLOSURE LIGHT	2.000	ELECTRA	ELETTGEC12	BLACK END ,PLASTIC TUBE 48", PROTECTION
85	ZS307	1.000	HAMMOND	FLKDS	DOOR SWITCH
100	REC311	1.000	HUBBELL	611	ELECTRICAL BOX CSAUL
110	REC311	1.000	HUBBELL	864	DUPLEX PLUG COVER CSAUL
120	REC311	1.000	LEVITON	5320-1CP	DUPLEX RECEPTACLE 120V 15A BEIGE
150	DISC106	1.000	ALLEN-BRADLEY	194R-NU200P3	DISC/SWITCH FUSED 600V 3P 200A CLASS J
160	DISC106	1.000	ALLEN-BRADLEY	194R-R4	DISC/SWITCH 100/200A ROD 15.9"
170	DISC106	1.000	ALLEN-BRADLEY	194R-HM4	DISC/SWITCH OPERATE HANDLE BLK/GRAY N4X
180	DISC106	3.000	ALLEN-BRADLEY	194R-FCD1	DISC/SWITCH 200A FUSE COVER
190	DISC106	1.000	ALLEN-BRADLEY	194R-LNC4	LUG PROTECTION FOR 200A DISC
195	DISC106	1.000	ALLEN-BRADLEY	199-LF1	DISC/SWITCH 194R 200A 3 LUG SET
200	DISC106	3.000	BUSSMANN	LPJ-150SP	TIME DELAY FERRULE FUSE, CLASS J, 600V,
210	T114	1.000	MARCUS	MTC-3000-39	TRANSFO. P.600V, S:120V, 3000VA
220	F114	1.000	ALLEN-BRADLEY	1492-FB2C30	FUSE HOLDER CLASS CC 600V 2P 30A
230	F114	2.000	BUSSMANN	FNQ-R-15	TIME-DELAY REJECTION TYPE CC 10.3X38.1MM
240	F116	1.000	ALLEN-BRADLEY	1492-FB1C30	FUSE HOLDER CLASS CC 600V 1P 30A
250	F116	1.000	BUSSMANN	LP-CC-25	TIME DELAY FERRULE FUSE CLASS CC 600V 25
260	SP109	1.000	ALLEN-BRADLEY	1492-PD31123	SPLITTER BAR 600V 3P 380A 1 LINE 12 LOAD
270	SP109	1.000	ALLEN-BRADLEY	1492-PBC3	POWER BLOCK COVER CLEAR PLEXIGLASS
280	M119,124,144,154,159,174,207,225,247,265,2A05,2A10,2A15,2A20	14.000	ALLEN-BRADLEY	100-C09D10	CONT 3P 9A COIL 120VAC 60Hz
285	M129,134,164,169	4.000	ALLEN-BRADLEY	100-C12D10	CONT 3P 12A COIL 120VAC 50/60HZ
290	ALL CB...	14.000	ALLEN-BRADLEY	140M-C-AFA10	AUX CONT 1NO FOR THERMO-M BREAKER 140M
291	CB119,124,154,159,2A20	5.000	ALLEN-BRADLEY	140M-C2T-B40	MOTOR PROTECTION CIRCUIT/B 2.5-4.0A
292	CB129,134,164,169	4.000	ALLEN-BRADLEY	140M-C2E-C16	MOTOR PROTECTION CIRCUIT/B 10-16A
293	CB144,174	2.000	ALLEN-BRADLEY	140M-C2E-B10	MOTOR PROTECTION CIRCUIT/B 0.63-1.0A

#	DESCRIPTOR	QTY REQ. UNIT	MANUFACTURER	MANUFACTURER PART #	DESCRIPTION
294	CB2A05,CB2A 10	2.000	ALLEN-BRADLEY	140M-C2E-C10	MOTOR PROTECTION CIRCUITB 6 3-10.0A
295	CB2A15	1.000	ALLEN-BRADLEY	140M-C2E-B25	MOTOR PROTECTION CIRCUITB 1 6-2.5A
300	FU207,225,247,265	4.000	ALLEN-BRADLEY	1492-FB3C30	FUSE HOLDER CLASS CC 600V 3P 30A
305	FL207A,225A	2.000	REX MANUFACTURING	3PR-0008C3H	LOAD REACTOR, 3PH, SERIES FOR VARIABLE S
306	LF247A,265A	2.000	REX MANUFACTURING	3PR-0002C3H	LOAD REACTOR, 3PH, SERIES FOR VARIABLE S
310	FU207,FU225	6.000	BUSSMANN	LP-CC-15	TIME DELAY FERRULE FUSE CLASS CC 600V 15
311	FU247,265	6.000	BUSSMANN	LP-CC-6	TIME DELAY FERRULE FUSE CLASS CC 600V 6A
368	MCR343A	1.000	ALLEN-BRADLEY	700-CF400-D	CONTROL RELAY 4NO COIL 120VAC 60HZ.
370	CR503,522,1008,1010,1014,1020,1030,1034,1036,1106,1110,1114,1120,1130,1134	15.000	OMRON	MY2-AC120(S)	PLUG-IN RELAY 2 CONTACT COIL 220/240VAC
371	CR1136,1806,1808,1834,1836	5.000	OMRON	MY2-AC120(S)	PLUG-IN RELAY 2 CONTACT COIL 220/240VAC
380	CR503,522,1008,1010,1014,1020,1030,1034,1036,1106,1110,1114,1120,1130,1134	15.000	OMRON	PYF08A-E	RELAY BASE 8 PIN FOR MY2 RELAY
381	CR1136,1806,1808,1834,1836	5.000	OMRON	PYF08A-E	RELAY BASE 8 PIN FOR MY2 RELAY
390	CR317A,317B	2.000	OMRON	MY4-AC120	PLUG-IN RELAY 4 FORM-C CONTACTS COIL 110
400	CR317A,317B	2.000	OMRON	PYF14A-E	RELAY BASE 14 PIN FOR MY4 RELAY
405	CR...	44.000	OMRON	PYC-A1	HOLD DOWN SPRING FOR RELAY (2 PER PACKAG
410	TR347,351,355,359	4.000	ALLEN-BRADLEY	700-FSA4UJ23	TIMER RELAY ON-DELAY DPT COIL 240VAC
420	MC1016,1018,1020,1024,1032,1116,1118,1120,1124,1132,1810,1812,1814	13.000	ENVITECH	ENVMC3P	MODULE CONTOURNEMENT,3POS,DIGITAL,M-O-A
430	S1428,1528	2.000	ENVITECH	ENVMC2P	MODULE CONTOURNEMENT,2POS,ANALOG,M-A
431	POT1428,1528	2.000	ENVITECH	ENVMCPOT5K	MODULE CONTOURNEMENT,POT 5KOHM,ANALOG
432	CA1428,1528	2.000	WEIDMULLER	990881	POTENTIOMETER TO 4/20MA CONVERTER
433	CA1428,1528	2.000	WEIDMULLER	C9039986	END PLATE FOR TERMINALS.
434	RA1428,1528	2.000	ABB	ISNA610059R1500	RELAY INT/ISOL 2 CONT COIL 24VDC 1LED
460	IL1012,1112	2.000	ALLEN-BRADLEY	800FP-P3	PILOT LIGHT OPERATOR (PLASTIC), GREEN,
462	IL1012,1112	2.000	ALLEN-BRADLEY	800F-NEG	INTEGRATED LED MODULE, GREEN, 120VAC
464	IL1006	1.000	ALLEN-BRADLEY	800FP-P4	PILOT LIGHT OPERATOR PLASTIC, RED 22.5MM
466	IL1006,ES343	2.000	ALLEN-BRADLEY	800F-NSR	INTEGRATED LED MODULE, RED, 120VAC
468	IL315	1.000	ALLEN-BRADLEY	800FP-P7	PILOT LIGHT OPERATOR, CLEAR, 22.5MM, TY
470	IL315	1.000	ALLEN-BRADLEY	800F-NSW	INTEGRATED LED MODULE, WHITE, 120VAC
474	PB317,706	2.000	ALLEN-BRADLEY	800FP-F2	22.5MM FLUSH HEAD PUSH BUTTON BLACK
476	PB806,906	2.000	ALLEN-BRADLEY	800FP-F3	22.5MM FLUSH HEAD PUSH BUTTON GREEN
480	ES343	1.000	ALLEN-BRADLEY	800FP-LMT44	MUSHROOM HEAD PUSH BUTTON, RED HEAD ILLU



ENVITECH AUTOMATION INC.
180 BRUNSWICK.
POINTE-CLAIRE, QC H9R 5P9

CUSTOMER BILL OF MATERIEL
NC01, MEADOWBANK - A4765A, LOT: 2

#	DESCRIPTOR	QTY REQ. UNIT	MANUFACTURER	MANUFACTURER PART #	DESCRIPTION
481	ALL BUTTON	9.000	ALLEN-BRADLEY	800F-ALM	METAL MOUNTING LATCH, 22.5MM
482	ES343	1.000	ALLEN-BRADLEY	800F-X01	CONTACT BLOCK 1NF, FOR DERIE 800F
484	PB317,ES343,PB706,PB806,PB906	5.000	ALLEN-BRADLEY	800F-X10	CONTACT BLOCK 1NO, FOR DERIE 800F
490	PS542	1.000	PHOENIX	2866310	POWER SUPPLY,TRIO-PS/1AC/24VDC/5A
510	LF602	1.000	CUTLER-HAMMER	AGSHWCH120N05XS	LINE FILTER 120 VAC 5 AMP
520	F..	30.000	ALLEN-BRADLEY	1492-H4	TERMINAL/B 300VAC 12A 1P FUSIBLE NEON
525	F..	2.000	ALLEN-BRADLEY	1492-N37	TERMINAL/B FUSIBLE 1492-H4/5/6 END PLATE
530	F...(3 SPARE)	11.000	BUSSMANN	AGC-0.5	FAST ACTING MINIATURE FUSE 250V 0.5A
535	F...(3 SPARE)	14.000	BUSSMANN	AGC-1	FAST ACTING MINIATURE FUSE 250V 1A
540	F...(3 SPARE)	10.000	BUSSMANN	AGC-2	FAST ACTING MINIATURE FUSE 250V 2A
545	F...(2 SPARE)	6.000	BUSSMANN	AGC-5	FAST ACTING MINIATURE FUSE 250V 5A
560	CB307,311,315,369,371	5.000	WEIDMULLER	9926251005	BRANCH CIRCUIT BREAKER, 1POLE, 5A, CSA.
564	CB373	1.000	WEIDMULLER	992625-1-0-3	BRANCH CIRCUIT BREAKER, 1POLE, 3A, CSA.
580	TB	182.000	WEIDMULLER	102010	TERMINAL BLOCK 600V, 35A, TYPE WDU
585	TB	83.000	WEIDMULLER	102020	TERMINAL BLOCK 800V 41A TYPE WDU 6
590	TB	20.000	WEIDMULLER	163194	TRANSPARENT COVER FOR MARKER HOLDER SCHT
600	TB	20.000	WEIDMULLER	163193	MARKER HOLDER FOR RAIL TS 32 AND TS 35 T
610	TB	24.000	WEIDMULLER	105000	TERMINAL/B END PLATE WDU 2.5
620	TB	22.000	WEIDMULLER	105010	LARGE END PLATE FOR TERMINALS WDU 4 TO 1
630	TB	37.000	WEIDMULLER	178418	TERMINAL BLOCK TRIPLE 250VAC 23A TYPE DL
640	TB	6.000	WEIDMULLER	178421	END PLATE FOR TERMINALS DLD 2.5
650	TB	20.000	WEIDMULLER	38356	TERMINAL/B END HOLDER EW35 BEIGE
660	PATC CORD	1.000	ORTRONICS	MC5E03-08	PATCH CORD GREY CATEGORY 5E 3 FEET
661	PATCH CORD	1.000	ORTRONICS	MC5E09-08	PATCH CORD GREY CATEGORY 5E 9 FEET
670	NPLATE	10.000	ENVITECH	NAMEPLATE	NAME PLATE AS PER DRAWING
JUNCTION BOX (QTY: 1)					
10	JB9-510, JB9-520	2.000	HAMMOND	PJ20168H	PANEL IN POLYESTER NEMA 4X, 20HX16WX8D
20	JB9-510, JB9-520	2.000	HAMMOND	P2068	MOUNTING PLATE GAUGE FOR SERIES PJ PANE
30	JB2-011, JB2-021	2.000	HAMMOND	PJ20168	PANEL IN POLYESTER NEMA 4X, 20HX16WX8D
40	JB2-011, JB2-021	2.000	HAMMOND	P2068	MOUNTING PLATE GAUGE FOR SERIES PJ PANE
180	TB	138.000	WEIDMULLER	102010	TERMINAL BLOCK 600V, 35A, CSA, TYPE WDU
190	TB	44.000	WEIDMULLER	102020	TERMINAL BLOCK 800V 41A TYPE WDU 6
200	TB	31.000	WEIDMULLER	105010	LARGE END PLATE FOR TERMINALS WDU 4 TO 1



ENVITECH AUTOMATION INC.
180 BRUNSWICK.
POINTE-CLAIRE, QC H9R 5P9

CUSTOMER BILL OF MATERIEL
NC01, MEADOWBANK - A4765A, LOT: 2

#	DESCRIPTOR	QTY READ. UNIT	MANUFACTURER	MANUFACTURER PART #	DESCRIPTION
210	TB	6.000	WEIDMULLER	105000	TERMINAL/B END PLATE WDU 2.5
220	TB	4.000	WEIDMULLER	178418	TERMINAL BLOCK TRIPLE 250VAC 23A TYPE DL
230	TB	2.000	WEIDMULLER	178421	END PLATE FOR TERMINALS DLD 2.5
260	TB	12.000	WEIDMULLER	38356	TERMINAL/B END HOLDER EW35 BEIGE
270	PB4A05,PB4A45	2.000	ALLEN-BRADLEY	800FP-F2	22.5MM FLUSH HEAD PUSH BUTTON BLACK
280	PB4A05(4),PB4A45(3),HS2321(3),2361(3),2421(3),2521(3),2561(3),2621(3)	25.000	ALLEN-BRADLEY	800F-X10	CONTACT BLOCK 1NO. FOR DERIE 800F
290	HS2321,2361,2421,2521,2561,2621	6.000	ALLEN-BRADLEY	800FP-SM32	22.5MM 3 POSITION MAINTAINED SELECTOR SW
300	ALL BUTTON	8.000	ALLEN-BRADLEY	800F-ALM	METAL MOUNTING LATCH, 22.5MM
310		12.000	ENVITECH	NAMEPLATE	NAME PLATE AS PER DRAWING
LOCAL STATIONS (QTY: 1)					
10	HS1022,1026,11028,1122,1126,1128	6.000	HOFFMAN	Q-1PBPCDM	STATION FOR BUTTON, 3.23" X 3.15" X 2.1
15	(HS1806 AND POT257), (HS1808 AND POT275)	2.000	HOFFMAN	Q-2PBPCDM	PUSHBUTTON ENCLOSURE, 4.45" X 2.87" X 3.
20	HS1022,1026,11028,1122,1126,1128,1806,1808	8.000	ALLEN-BRADLEY	800FP-SM32	22.5MM 3 POSITION MAINTAINED SELECTOR SW
30	HS1022(3),1026(3),1028(3),1122(3),1126(3),1128(3),1806(2),1808(2)	22.000	ALLEN-BRADLEY	800F-X10	CONTACT BLOCK 1NO. FOR DERIE 800F
40	HS1022,1026,11028,1122,1126,1128,1806,1808	8.000	ALLEN-BRADLEY	800F-ALM	METAL MOUNTING LATCH, 22.5MM
50	NPLATE	10.000	ENVITECH	NAMEPLATE	NAME PLATE AS PER DRAWING
60	POT257,275	2.000	ALLEN-BRADLEY	800FP-POTS	POTENTIOMETER 5KOHM, 2W
LOCAL DISCONNECT (QTY: 1)					
10	DS119,124,129,134,144,154,159,164,169,174,207,225,2A05,2A10	14.000	MOELLER	P1-25/12/SVB-NA	LOCAL DISCONNECT SWITCH 20 AMP, 575VAC
20	DS119,124,129,134,144,154,159,164,169,174,207,225,2A05,2A10	14.000	MOELLER	HI11-P1/P3Z	AUXILIARY CONTACTS FOR P1-XXX, 1 NO, 1 N
30	DS119,124,129,134,144,154,159,164,169,174,207,225,2A05,2A10	14.000	ENVITECH	NAMEPLATE	NAME PLATE AS PER DRAWING
SUPPLY BY JMI (QTY: 1)					
10	HMI373	1.000			2711P-T6C20A OPERATOR INTERFACE
20	PLC	1.000			1746-L551 PROCESSOR
30	PLC	1.000			1746-A13 PLC RACK
35	PLC	1.000			1746-A4 PLC RACK
37	PLC	1.000			1746-XX EXTENSION CABLE
40	PLC	1.000			1746-P4 POWER SUPPLY
50	PLC	1.000			1746-P2 POWER SUPPLY



ENVITECH AUTOMATION INC.
180 BRUNSWICK.
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CUSTOMER BILL OF MATERIEL
NC01, MEADOWBANK - A4765A, LOT: 2


#	DESCRIPTOR	QTY REQ. UNIT	MANUFACTURER	MANUFACTURER PART #	DESCRIPTION
60	PLC	4.000			1746-IB16 INPUT MODULE
70	PLC	3.000			1746-OW16 RELAY MODULE
80	PLC	2.000			1746-N18 ANALOG MODULE
90	PLC	3.000			1746-NO4I ANALOG MODULE
100	VFD207.225	2.000			ATV31HU40S6X
105	VFD247.265	2.000			ATV31H075S6X
110	E-SWITCH	1.000			SL-5MS-MDM-1 ETHERNET SWITCH
120	INST503.522	2.000			HPL220
130	INST4A03.4A12.4A21.4A30.4A43.4A52.4A61	7.000			SEEP EX

LEFT BLANK

ELECTRICAL DRAWINGS

LEFT BLANK

MEADOWBANK MINING CORP., NWT
 (2) ACTIFLO ACP-700R
 COAGULANT, POLYMER, SERVICE
 WATER, HCS

 Envitech CERTIFIED ISO9001 Automation Inc. <i>Innovation in systems / Systems Integration</i>		Drawing: A-755A Size: 1" AT PLOT SCALE		REV:		SIB: JUL 23/14 D. ANG	
A AS BUILT B FOR APPROVAL		DESCRIPTION		DATE		DWG. NO.	
2009/09/19 2009/04/16		18 JCD		18 JCD		18 JCD	
THIS DRAWING IS THE PROPERTY OF ENVITECH. IT IS TO BE USED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREON. IT IS NOT TO BE REPRODUCED, COPIED, OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, WITHOUT THE WRITTEN PERMISSION OF ENVITECH. ANY VIOLATION OF THIS NOTICE WILL BE CONSIDERED A BREACH OF CONTRACT AND SUBJECT TO LEGAL ACTION.							
DESIGNER DATE CHECKER DATE DRAWN DATE SCALE		TITLE (2) ACTIFLO ACP-700R TITLE PAGE		CLIENT MEADOWBANK MINING CORP., NWT		PROJECT NO. NC01-001-E00-001	
1 OF 2		1 OF 2		1 OF 2		1 OF 2	

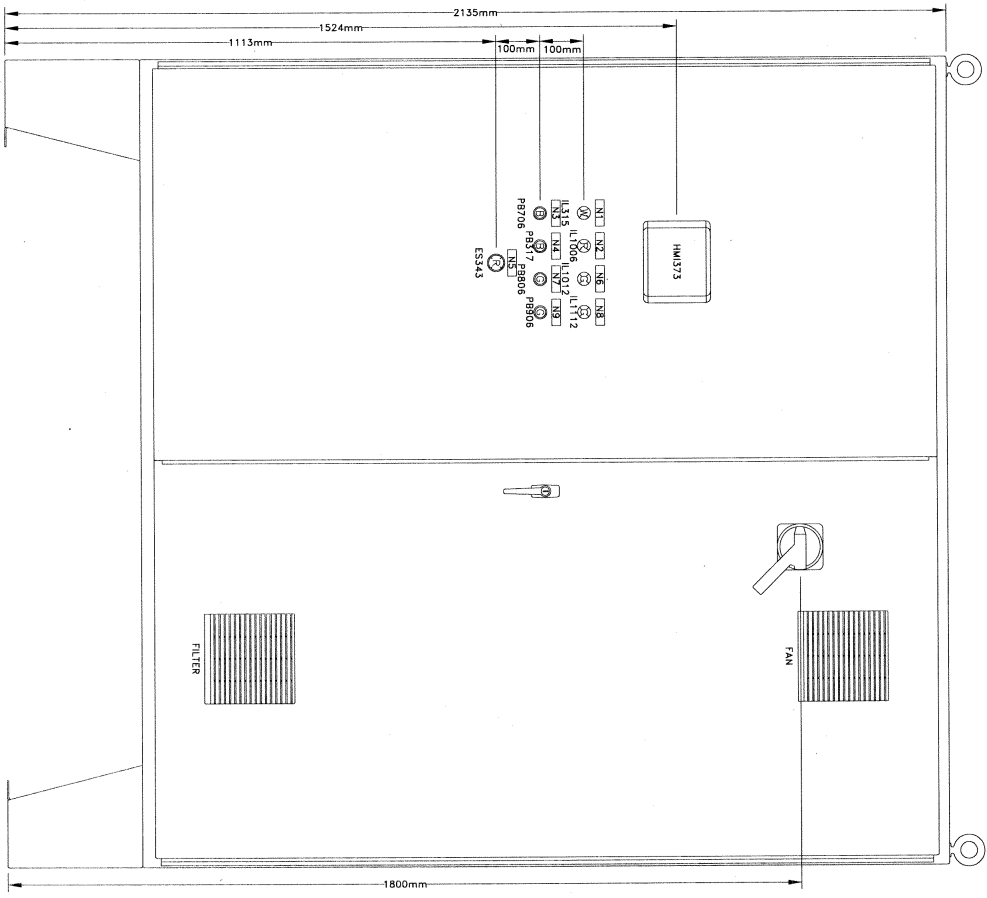
LEGEND	
	PRESSURE SWITCH
	PRESSURE SWITCH
	LEVEL SWITCH
	LEVEL SWITCH
	LIMIT SWITCH
	LIMIT SWITCH
	FLOW SWITCH
	FLOW SWITCH
	RELAY SWITCH
	RELAY CONTACT
	RELAY CONTACT
	ON DELAY TIMER
	ON DELAY TIMER
	MAINTAINED 2 POSITIONS SELECTOR SWITCH
	MAINTAINED 3 POSITIONS SELECTOR SWITCH
	SPRING RETURN TO CENTRE 3 POSITIONS SELECTOR SWITCH
	PUSH BUTTON
	PUSH BUTTON
	PUSH BUTTON
	PUSH BUTTON
	EMERGENCY STOP BUTTON
	POTENTIOMETER
	PILOT LIGHT
	PUSH TO TEST PILOT LIGHT
	RELAY COIL
	RELAY COIL WITH SURGE SUPPRESSOR
	CONTACTOR COIL
	CONTACTOR COIL WITH SURGE SUPPRESSOR
	ALARM
	RESISTOR
	SOLENOID
	1 POLE THERMAL MAGNETIC BREAKER
	3 POLES THERMAL MAGNETIC BREAKER
	1 POLE FUSING DISCONNECT SWITCH
	3 POLES FUSING DISCONNECT SWITCH
	3 POLES OVERLOAD RELAY
	1 POLE CIRCUIT BREAKER
	GROUND
	ISOLATED GROUND
	FUSE
	POWER BLOCK FOR FIELD WINDING
	TERMINAL FOR FIELD WINDING
	1 POLE TRANSFORMER

[illegible]

ENCLOSURE 72H X 72L X 18P In. WITH 12 In.
FLOOR STAND, NEMA 12, CSA APPROVAL

WIRING

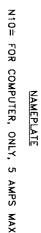
N1 = POWER SUPPLY
N2 = COMMON ALARM
N3 = ALARM ACKNOWLEDGE
N4 = EMERGENCY STOP
N5 = EMERGENCY STOP
N6 = ACTFLO 1, STATUS
N7 = ACTFLO 1, START/STOP
N8 = ACTFLO 2, STATUS
N9 = ACTFLO 2, START/STOP



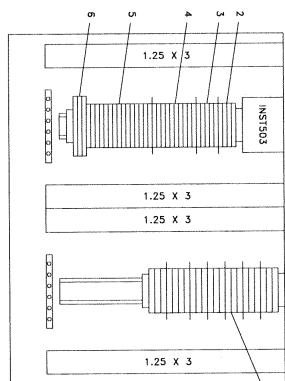
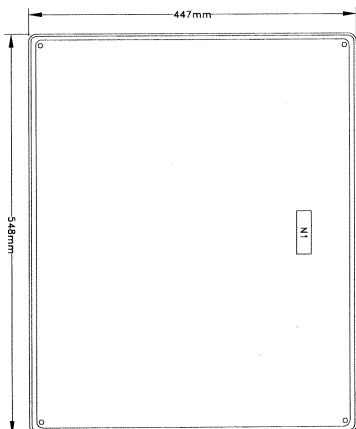
Envitech CERTIFIED ISO9001 Automation Inc. Integration of systems / Systems Integration		DATE: 2009/04/16 BY: JCD CHECKED: JCD APPROVED: JCD		TITLE: (2) ACTFLO ACP-700R PLC ENCLOSURE LAYOUT MEADOWBANK MINING CORP., NWT		PROJECT: N001-001-E02-001 SHEET: 1 OF 4	
DRAWING: AA7654 SCALE: 1" = 1" AT PLOT SCALE	REV: A FOR APPROVAL DATE: 2009/04/16 BY: JCD CHECKED: JCD APPROVED: JCD	COMMENTS: AS REQUESTED, THE ENCLOSURE WAS DESIGNED TO ACCOMMODATE THE FOLLOWING EQUIPMENT: 1. POWER SUPPLY (PS1706) 2. COMMON ALARM (PS1706) 3. ALARM ACKNOWLEDGE (PS1706) 4. EMERGENCY STOP (PS1706) 5. EMERGENCY STOP (PS1706) 6. ACTFLO 1 STATUS (PS1706) 7. ACTFLO 1 START/STOP (PS1706) 8. ACTFLO 2 STATUS (PS1706) 9. ACTFLO 2 START/STOP (PS1706)		SCALE:		PROJECT: N001-001-E02-001 SHEET: 1 OF 4	

SIG: 2M, 23x14, 0.2MG

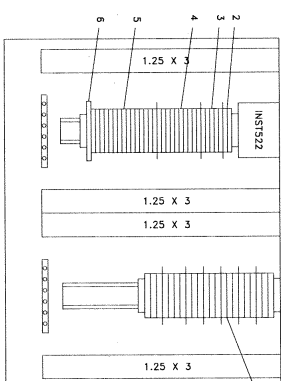
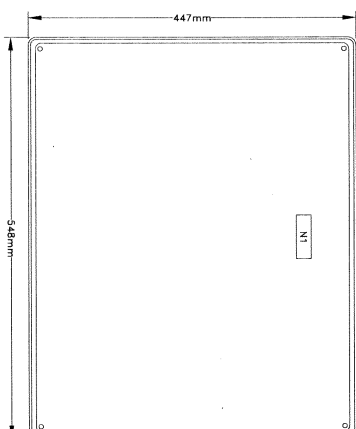
REF:

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JUNCTION BOX, NEMA4X, POLYESTER, P20168 SCREW COVER
N1 = JB2-011, ACTIFLO 1



- TERMINAL DESCRIPTION
1 = MOTORS
2 = 120VAC DIST.
3 = 120VAC DIST.
4 = RACK 1 SLOT 2
5 = RACK 1 SLOT 4
6 = RACK 1 SLOT 6
NOTE: RAIL WITH SPACER

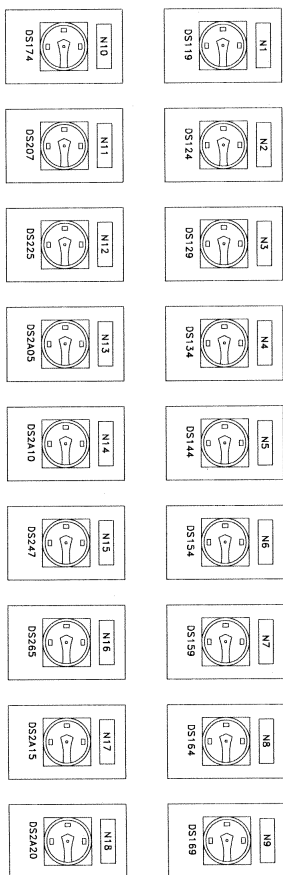


- TERMINAL DESCRIPTION
1 = MOTORS
2 = 120VAC DIST.
3 = 120VAC DIST.
4 = RACK 1 SLOT 2
5 = RACK 1 SLOT 4
6 = RACK 1 SLOT 6
NOTE: RAIL WITH SPACER

LOCAL DISCONNECT, NEMA3B, PLASTIC

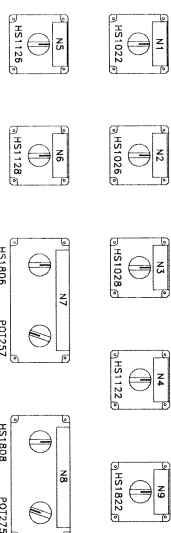
- N1 = ACTIFLO 1, COAGULATION MIXER
N2 = ACTIFLO 1, INJECTION MIXER
N3 = ACTIFLO 1, REGENERATION PUMP #1
N4 = ACTIFLO 1, REGENERATION PUMP #2
N5 = ACTIFLO 1, SCRAPER
N6 = ACTIFLO 2, REGENERATION MIXER
N7 = ACTIFLO 2, REGENERATION PUMP #1
N8 = ACTIFLO 2, REGENERATION PUMP #2
N9 = ACTIFLO 2, SCRAPER
N10 = ACTIFLO 2, SCRAPER
N11 = ACTIFLO 1, MATURATION MIXER
N12 = ACTIFLO 1, MATURATION MIXER
N13 = SERVICE WATER PUMP #1
N14 = SERVICE WATER PUMP #2

N15 = COAGULATION PREPARATION SYSTEM #1 FEEDER
N16 = COAGULATION PREPARATION SYSTEM #1 BLOWER
N17 = COAGULATION PREPARATION SYSTEM #1 BLOWER
N18 = COAGULATION TRANSFER PUMP
N19 = CAUSTIC SODA MIXER



LOCAL STATION, NEMA4X, POLYESTER

- N1 = ACTIFLO 1, REGENERATION PUMP #1, HAND-OFF-AUTO
N2 = SERVICE WATER PUMP #1, HAND-OFF-AUTO
N3 = ACTIFLO 1, REGENERATION PUMP #2, HAND-OFF-AUTO
N4 = ACTIFLO 1, REGENERATION PUMP #2, HAND-OFF-AUTO
N5 = SERVICE WATER PUMP #2, HAND-OFF-AUTO
N6 = ACTIFLO 2, REGENERATION PUMP #2, HAND-OFF-AUTO
N7 = COAG. PREP. HAND-OFF-AUTO
N8 = COAG. PREP. HAND-OFF-AUTO
N9 = CAUSTIC SODA MIXER, HAND-OFF-AUTO



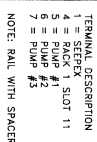
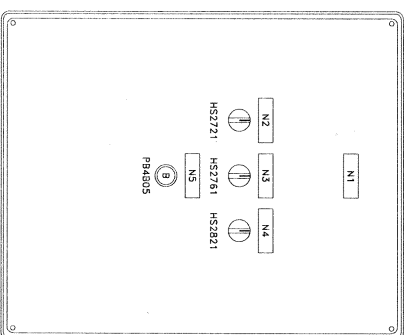
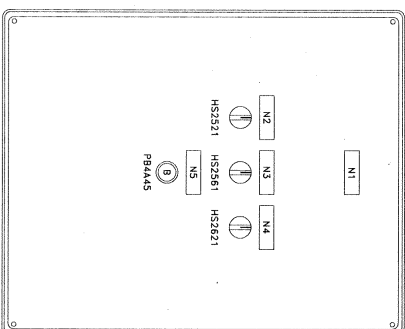
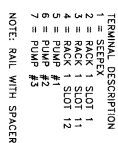
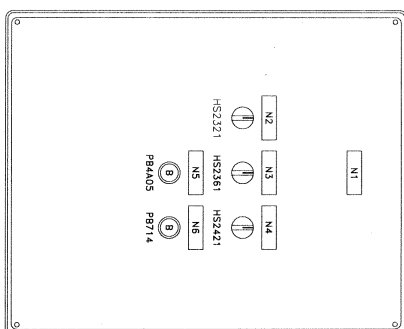
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Automation Inc.
Integration of operational Systems Integration

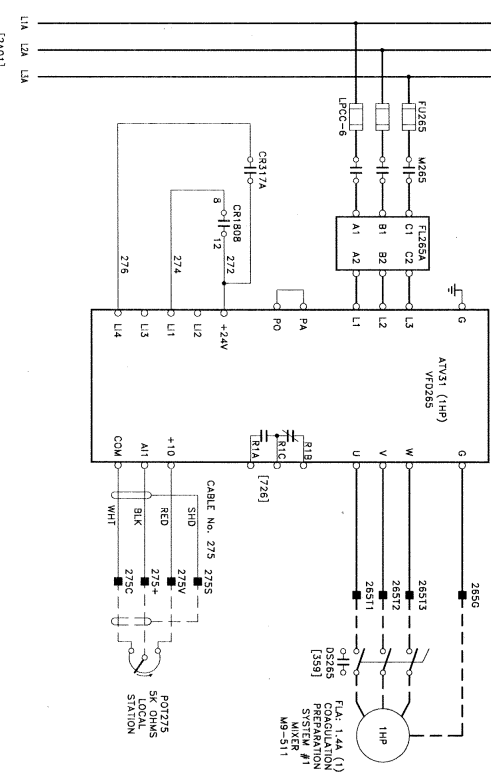
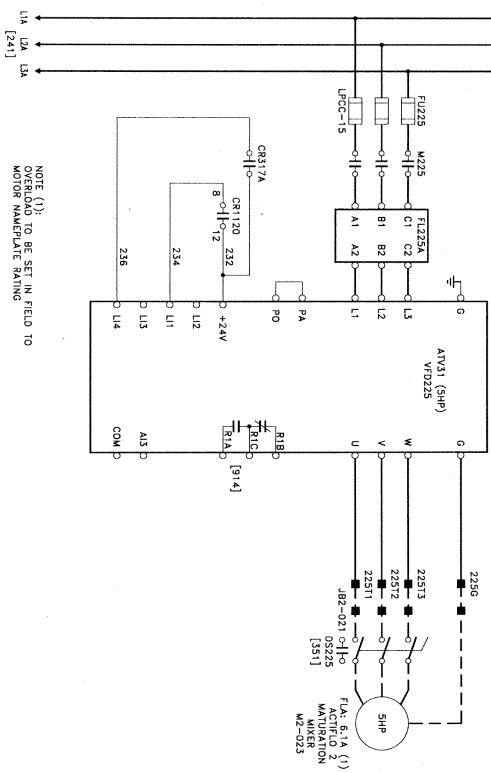
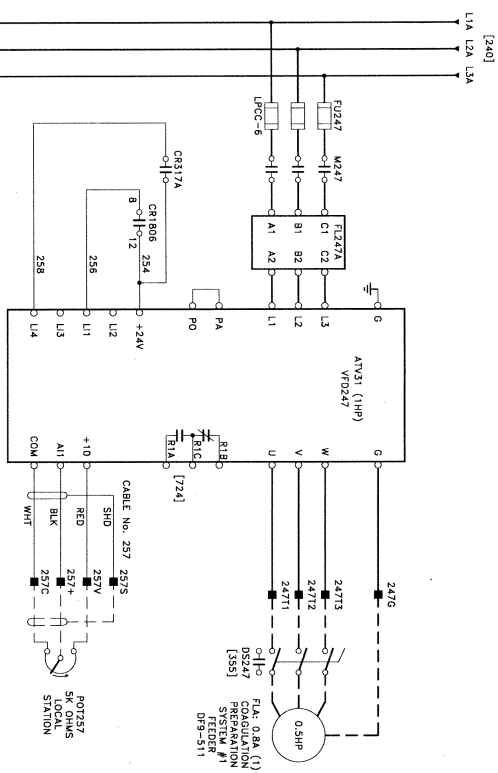
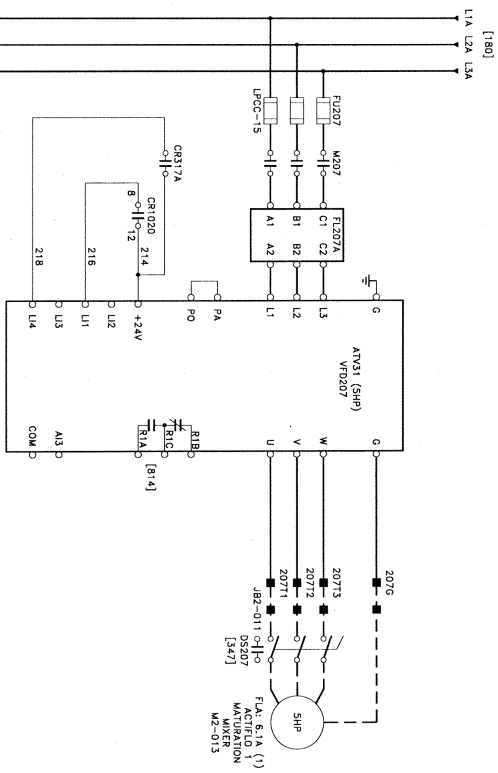
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PROJECT: 0001-001-003

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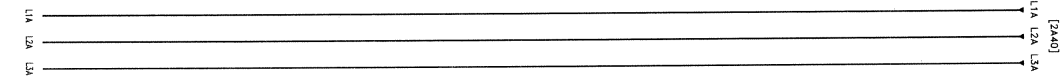


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NOTE (1):
OVERLOAD TO BE SET IN FIELD TO
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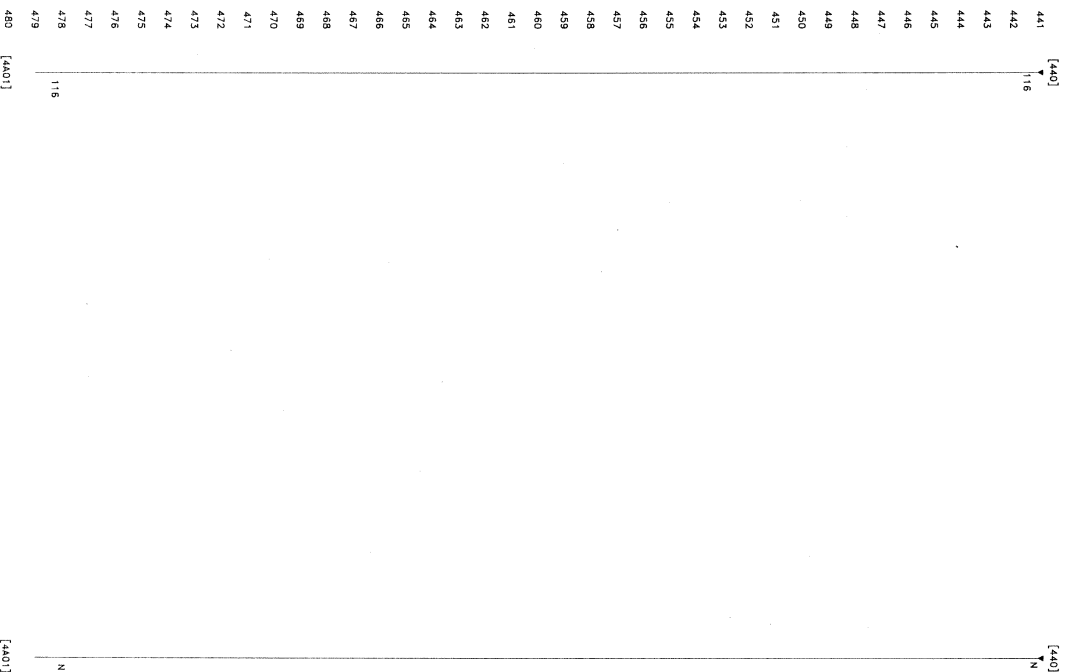


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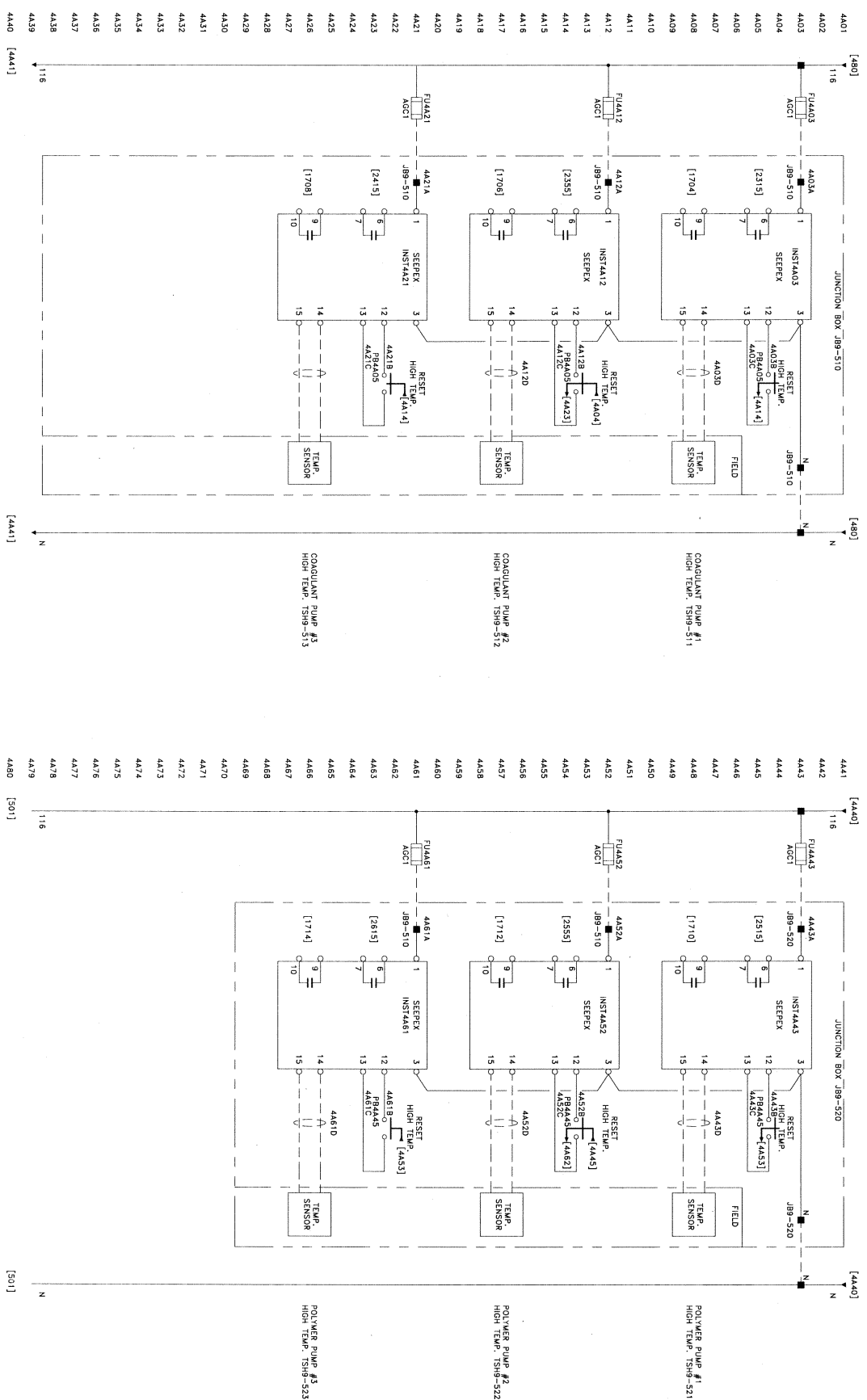
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