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SUBMITTAL TRANSMITAL

April 18, 2012
Submittal No: 11314-003 (OM)
(Includes Sections 11321 & 11322)

PROJECT: **Harold Thompson Regional WRF**
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Job No. 2908

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CONTRACTOR: **Schloss Engineered Equipment, Inc.**
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SUBJECT: Preliminary O&M Manual for the Recessed Impeller Pumps, Grit Separator Equipment and Vortex Grit Chambers

SPEC SECTION: 11314 – Recessed Impeller Pumps, 11321 – Grit Separator Equipment and 11322 – Vortex Grit Chambers

PREVIOUS SUBMISSION DATES:

DEVIATIONS FROM SPEC: ___ YES _X_ NO

CONTRACTOR'S STAMP: This submittal has been reviewed by Weaver Construction Management and, unless indicated otherwise, has been found to be in conformance with the intent of the contract documents.

Contractor's Stamp:	Engineer's Stamp:
Date: April 18, 2012 Reviewed by: Leslie Brown ( ) Reviewed Without Comments (X) Reviewed With Comments	

ENGINEER'S COMMENTS:_____
_____

Project: Harold D. Thompson WRF

Location: Fountain, CO

Supplier/Contractor: Schloss Engineered Equipment, Inc.

Date: 4/18/12

Submittal No/Spec. Section: 11314-003

WCM Submittal Review Comments:

1.) **Tag numbers and equipment identification numbers are to be labeled within the table of contents, on tabs in manual sections and on all drawings of revised O&M manuals.**

SCHLOSS ENGINEERED EQUIPMENT, INC.
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INSTALLATION, OPERATION & MAINTENANCE MANUAL

HAROLD D. THOMPSON
REGIONAL WATER RECLAMATION FACILITY
FOUNTAIN, CO

SPEC. SECTION 11322 – VORTEX GRIT CHAMBERS
SPEC. SECTION 11314 – RECESSED IMPELLER PUMPS
SPEC. SECTION 11321 – GRIT SEPARATOR EQUIPMENT

SCHLOSS ENGINEERED EQUIPMENT, INC.
SEE PROJECT NO. 1757-11

INSTALLATION, OPERATION & MAINTENANCE MANUAL

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SECTION I

GENERAL

GRIT COLLECTOR

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "CPT" GRIT COLLECTOR

STORAGE OF EQUIPMENT

If the equipment is to be stored or is otherwise out of use for more than 30 days, the following precautions must be taken to protect against corrosion and assure operating readiness.

FAILURE TO COMPLY WITH THESE INSTRUCTIONS WILL VOID ANY FACTORY WARRANTY!

General Storage Precautions

1. Always store controls and drive equipment in normal operating position.

2. If possible, store controls and drives indoors in a dry, well-ventilated place with a relatively constant temperature.

3. When controls and drive equipment are not installed, but must be outdoors:

    a. Use wooden blocks to elevate above ground, arranged for even and firm support. Shipping crates or skids may be used. Make certain storage area is not where water can collect.

    b. Use protective covers, but allow for adequate ventilation.

    c. When possible, store in a shaded area protected against wind and out of the way of moving equipment.

4. Apply a corrosion inhibitive agent to all unpainted metal surfaces, such as shafting. For short storage periods, a coat of oil is sufficient.

Short Term Storage

If the equipment is installed, but will not be operating for a period of up to one month, leave the power connected. Operate the equipment for about five minutes once a week to lubricate all running surfaces.

If the equipment will be stored less than one month, including transit time, no special precautions are required.

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "CPT" GRIT COLLECTOR

STORAGE OF EQUIPMENT (cont'd)

Long Term Storage

Mechanical Equipment

The following precautions cover shutdown periods exceeding one month.

When power is available:
Lubricate all equipment, and then operate for about five minutes or at least one complete cycle once each week. Follow all recommended lubrication and maintenance instructions.

When power is not available:
Fill the reducer housings with clean oil to the maximum level. It is recommended that a rust inhibitive agent be added. Fill all reducer housings as some reducers have more than one. Cover seals, chains and guides with heavy grease. Cover breather caps with tape. Cover the equipment, but allow adequate ventilation.

Once each month open drain plugs to remove any water and verify the oil is at the maximum level. Check all greased items, add grease if needed. Turn reducer over several times by hand.

After six months, drain all oil from gearboxes, and refill per the lubrication instructions. Lubricate all greased bearings.

Structural

Inspect painted surfaces for deterioration of paint. Touch up surfaces as needed.

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "CPT" GRIT COLLECTOR

INSTALLATION INSTRUCTIONS

It is very important to properly install the grit collector in order to help provide an installation that will operate for many years. The order of installation is as follows:

1. **Site Preparation:**
   Clean the area around where the grit collector is to be installed. Roughen concrete where grout is required in order to provide a good bond between the concrete and grout.

2. **Unloading and Handling:**
   Take extra care in unloading and handling the equipment. Keep the equipment clean and dry. Use proper slings and rigging when handling heavy pieces of equipment. Become familiar with the parts and assemblies as shown on the general arrangement drawing. **DO NOT PUT SLING OR CABLE AROUND THE TURBINE SHAFT AND LIFT** as this may bend the shaft or damage the bearings.

3. **Centerlines and Work Points:**
   Establish and scribe centerlines and work points for various parts of the equipment.

4. **Install Grit Collector:**
   The grit collector is normally shipped without the turbine shaft and paddle assembly mounted in the speed reducer. Upon assembly, coat the shaft with grease, grease the bore of the reducer, and insert the key into the shaft. Remove the dust cap from the topside of the reducer. Visual inspection will show a retainer washer and bolt. These items would be used only if the end of drive shaft is drilled and tapped. If the end of drive shaft is drilled and tapped, then remove the retainer washer and bolt by removing the 'C'-clip inside the hollow shaft of the reducer. Insert the shaft into and through the speed reducer hollow shaft bore. Then secure the retaining collar in the machined notch at the upper end of the shaft. Once the equipment is properly located, secure the base with anchor bolts. Level the equipment, be sure that the turbine shaft is plumb in both north-south and east-west directions and tighten the anchors.

5. **Lubrication:**
   Verify that the reducer is filled with oil. **THIS MUST BE DONE PRIOR TO ANY OPERATION OF THE MOTOR, INCLUDING JOGGING.**

   Note: After the first thirty days, drain the oil in the gear reducer then flush and refill with the proper grade of lubricant per the Manufacturer's Instructions.

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "CPT" GRIT COLLECTOR

INSTALLATION INSTRUCTIONS (cont'd)

6. Test Run:

Inspect and properly tighten all bolts and fasteners. Check that all parts are properly lubricated. Remove any debris from the tank and check for any objects that may block rotation of the paddles. Verify proper rotation of the turbine. The correct direction is that which will cause the water to be pumped upwards. Jog the turbine through several rotations before test running. Carefully listen for any unusual noises. Make any required adjustments only after **LOCKING OUT THE MOTOR**. Be careful at all times. Replace any guard that may have been removed for the test run.

Retighten all fasteners after several hours of test running. Again, remember to **LOCK OUT THE DRIVE MOTOR** before doing any work on the collector. Retighten the fasteners again in one month, six months (or sooner, if required) and as required thereafter.

KEEP HANDS, FEET AND ALL PARTS OF THE BODY, CLOTHING, AND TOOLS OUT OF THE GRIT COLLECTOR. SERIOUS OR FATAL INJURY CAN OCCUR IN AN INSTANT.

7. Grouting:

After the grit collector has run for twenty-four hours, verify plumb, level and alignment. The grouting may then be done. Make any final adjustments to the components that are to be grouted. It is recommended that a premixed non-shrinking grout be used. Grout per grout manufacturer's instructions.

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "CPT" GRIT COLLECTOR

START-UP AND SHUTDOWN PROCEDURES

After the equipment has been installed and adjusted in accordance to the installation instructions, the equipment is ready for start-up. Before starting the equipment, it is important that all lubrication procedures have been followed, reducers have been filled to the proper level with oil and all grease fittings have been properly greased. Remove any tools or other materials that may block proper operation of the equipment. Any safety guards that have been removed should be returned.

Check the power to the motors for the proper voltage. Once the precautions above have been completed, the drive motor can be started. Read and compare the amperage draw on each motor leg with the motor nameplate data. Carefully check the equipment through several cycles for proper operation. If there is any malfunction of the equipment, check the trouble-shooting guide or consult Schloss Engineered Equipment, Inc.

The equipment can be shut down at any time by turning the **Hand-Off-Auto** selector switch to "off" or turning the disconnect switch to the "off" position. The procedure may be different depending on the electrical controls furnished. For extended shutdown procedures, see the section on storage of equipment.

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "CPT" GRIT COLLECTOR

OPERATION INSTRUCTIONS

Function:

The Schloss Engineered Equipment, Inc. Type "CPT" Grit Collector is designed to remove the specified grit size or larger sized particles from the flow of sewage passing through the chamber. This process is accomplished by controlling the retention time (surface loading rate), water velocities and directions in the tank. Often, the settled grit contains larger organic particles that settle at the same velocity as the more dense grit particles, and consequently the settled grit from the tank underflow is pumped to a grit separation device, such as the Schloss 12SW-CL for enhanced removal of the putrescible.

Process:

The screened sewage flow is directed into the collector, where settlement occurs. The surface area of the water governs this settlement, the retention time (surface loading rate) in the tank, and the water velocity and direction.

The most effective performance is usually obtained with the water velocity entering the tank at a speed of 1.25 to 1.5 feet per second. In addition, the turbine diameter can be adjusted to optimize grit collection and removal.

Results:

Heavy, inorganic grit is settled and removed. It is then pumped to a grit separation device, or classifier to wash and dewater it.

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "CPT" GRIT COLLECTOR

SAFETY, LUBRICATION AND MAINTENANCE INSTRUCTIONS

Introduction

A regular maintenance program will help provide long, dependable service. Please refer to the Manufacturer's Data included in later sections of this manual for complete instructions on the lubrication and maintenance of the individual components.

Frequencies listed are for normal operation and conditions. Adjust as required to suit actual service conditions.

An approved equal may substitute specified lubricants. Consult your lubricant supplier for recommendations.

Check nameplates on the drive unit and bearings for correct lubrication.

Note: After the first thirty days of operation, drain the oil in the gear, then flush and refill with the proper grade of lubricant per the Manufacturer's Instructions.

Safety

1. Follow all instructions. Learning about the equipment will help make the equipment easier and safer to operate.
2. **ALWAYS LOCK OUT THE DRIVE BEFORE WORKING ON THE EQUIPMENT.** All guards must be in place before operating the equipment.
3. We recommend that handrails, toe plates, warning signs, and cover plates be installed at all times during equipment operation.
4. **KEEP HANDS, FEET, AND ALL PARTS OF THE BODY, CLOTHING, AND TOOLS OUT OF THE GRIT COLLECTOR. SERIOUS OR FATAL INJURY CAN OCCUR IN AN INSTANT.**

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "CPT" GRIT COLLECTOR

SAFETY, LUBRICATION AND MAINTENANCE INSTRUCTIONS (cont'd)

Lubrication Schedule

The following lubrication schedule is applicable only after the lubrication required during the initial equipment break-in period has been performed. **ALWAYS LOCK OUT THE DRIVE** before performing any lubrication or maintenance on this equipment.

Equipment	Lubricant	Frequency
Reducer/grease lubricated seals (If provided)	#2 Grease	Semi-Annually
Reducer/Oil	* Lubricate unit per Manufacturer's Recommendations	Semi-Annually or 2500 hrs
Motor Bearings	Lubricate unit per Manufacturer's Recommendations.	Annually

* Gear Oil Specification is dependent upon the type of reducer and the actual operating conditions. Heavier oil is normally required during the summer months.

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "CPT" GRIT COLLECTOR

SAFETY, LUBRICATION AND MAINTENANCE INSTRUCTIONS (cont'd)

Maintenance and Inspection

The following maintenance schedule is applicable only after all maintenance required during the initial equipment break-in period has been performed. Refer to Manufacturer's Data for break-in maintenance instructions. **ALWAYS LOCK OUT THE DRIVE** before performing any lubrication or maintenance on this equipment.

Equipment	Procedure	Frequency
All Components	Visual inspection of all parts to observe condition.	Daily
Reducer	Check oil level and breather.	Monthly
Bolts & Fasteners	Check for looseness; Re-tighten as required.	Monthly
Turbine Blade	Check for wear	Semi-Annually
All Components	Check all parts; clean or replace worn or damaged parts. Touch up any nicks or scratches in paint.	Semi-Annually or Annually

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "CPT" GRIT COLLECTOR

TROUBLESHOOTING GUIDE

The following list of equipment and operational problems and their probable cause is provided to guide the experienced operator in simple troubleshooting. More involved troubleshooting may require a telephone call directly to Schloss Engineered Equipment, Inc. Always perform troubleshooting in a logical, orderly manner. Remember, isolation is the key to successful troubleshooting. No troubleshooting guide can have answers to all the problems that may arise. Answers to some problems will only come through experience. **ALWAYS LOCK OUT THE DRIVE WHEN REQUIRED.**

A. Equipment Problems:

1. **Motor will not start:** Check power source for wiring overloads, interlocks, etc. If an overload is encountered, carefully check equipment for jamming before resetting.

2. **Motor overheats:** Check for overloading conditions. Check actual voltage and amperage draw against motor nameplate and heater ratings.

3. **Motor producing unusual noise:** Check bearings for proper lubrication.

4. **Oil leaks around the drive reducer:** Check to see that the fill, drain and breather are in the correct location. Check breather according to Manufacturer's Instructions.

5. **Reducer wobbles:** Check turbine shaft for straightness. Check all fasteners for proper tightness. Check that all turbine blades are set at the same diameter. Check that no rags are caught on the blades. Clean as necessary.

6. **Reducer overheats:** Check for quality, type and quantity of oil. Refer to Manufacturer's Instructions.

7. **Drive reducer producing unusual noise and vibrations:** Refer to Manufacturer's Instructions as this may indicate a serious condition requiring immediate attention. Check turbine blades for damage or looseness.

8. **Excessive and oversized grit are reporting to the clarifiers:** Water velocity in the tank is too high. At some very high flows, it may be necessary to halt the turbine rotation. The turbine diameter may be adjusted, however, it is suggested that the SEE engineering department be contacted if this is required.

GRIT WASHER

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "SW-CL" GRIT CLASSIFIER/WASHER

STORAGE OF EQUIPMENT

If the equipment is either stored or out of use for more than 30 days, precautions must be taken to protect against corrosion in order to assure operating readiness.

FAILURE TO COMPLY WITH THESE INSTRUCTIONS WILL VOID ANY FACTORY WARRANTY!

General Storage Precautions

1. Always store drive equipment in normal operating position.

2. If possible, store drives indoors in a dry, well - ventilated place with a relatively constant temperature.

3. When drive equipment is not installed, but must be outdoors:

   a. Use wooden blocks to elevate above ground, arranged for even and firm support. Shipping crates or skids may be used. Make certain storage area is not where water can collect.

   b. Use protective covers, but allow for adequate ventilation.

   c. When possible, store in a shaded area protected against wind and out of the way of moving equipment.

4. Apply a corrosion inhibitive agent to all unpainted metal surfaces, such as shafting. For short storage periods, a coat of oil is sufficient.

Short Term Storage

If the equipment is installed, but will not be in operation for up to one month, leave the power connected. Operate the equipment for about five minutes once a week to lubricate all running surfaces.

If the equipment will be stored less than one month, including transit time, no special precautions are required.

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "SW-CL" GRIT CLASSIFIER/WASHER

STORAGE OF EQUIPMENT (cont'd)

Long Term Storage

Mechanical Equipment

The following precautions cover shutdown periods that exceed one month.

When power is available:
All equipment should be lubricated and then operated for about five minutes or at least one complete cycle once each week. Follow all recommended lubrication and maintenance instructions.

When power is not available:
Fill the reducer housings with clean oil to the maximum level. It is recommended that a rust inhibitive agent be added. Some reducers have more than one housing so all housings should be filled. Cover seals, chains and guides with heavy grease. Cover breather caps with tape. Cover the equipment, but allow for adequate ventilation.

Once each month open drain plugs to remove any water and verify the oil is at the maximum level. Check all greased items, add grease if needed. Turn reducer over several times by hand.

After six months, drain all oil from gearboxes, and refill per the lubrication instructions. Lubricate all greased bearings.

Structural

Inspect painted surfaces for deterioration of paint. Touch up surfaces as needed.

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "SW-CL" GRIT CLASSIFIER/WASHER

INSTALLATION INSTRUCTIONS

It is very important that the grit classifier be installed properly in order to help provide the user with an installation that will operate for many years. The order of installation should be as follows:

1. **Site Preparation:**
   Clean the area around where the grit classifier is to be installed. Roughen concrete where grout is required in order to provide a good bond between the concrete and grout.

2. **Unloading and Handling:**
   Take extra care in unloading and handling the equipment. Keep the equipment clean and dry. Use proper slings and rigging when handling heavy pieces of equipment. Become familiar with the parts and assemblies as shown on the general arrangement drawing. **DO NOT PUT SLING OR CABLE AROUND THE SPIRAL AND LIFT** as this may bend the screw or damage the bearings.

3. **Centerlines and Work Points:**
   Establish and scribe centerlines and work points for various parts of the equipment.

4. **Install Grit Classifier:**
   The grit classifier is normally shipped as a complete unit. Once the equipment is properly located, secure it with anchor bolts located at the end and on the support stand. Level the equipment and tighten the anchors.

5. **Install Lifting Mechanism: (If applicable)**
   Install lifting mechanism as indicated on the general arrangement drawing.

6. **Install Cyclone:**
   Install cyclone as indicated on the general arrangement drawing.

7. **Lubrication:**
   Verify that the lower bearing assembly and the reducer are filled with oil. The lower bearing assembly is filled with oil during fabrication of the unit and normally does not require refilling. However, if it appears that oil has been leaking from the assembly, it must be removed from the unit and refilled. The reason for the leakage must be determined and repaired. **THIS MUST BE DONE PRIOR TO ANY OPERATION OF THE MOTOR, INCLUDING JOGGING.**

INSTALLATION INSTRUCTIONS (cont'd)

Note: After the first thirty days, the oil in the gear reducer needs to be drained, flushed, and refilled with the proper grade of lubricant per the Manufacturer's Instructions.

8. Test Run:

Inspect and properly tighten all bolts and fasteners. Check that all parts are properly lubricated. Remove any debris from the trough and check for any objects that may block rotation of the screw. Check that the grit washer adequately clears the trough for its full length. Verify proper rotation of the screw. Jog the screw through several rotations before test running. Carefully listen for any unusual noises. Make any required adjustments only after **LOCKING OUT THE MOTOR**. Be careful at all times. Replace any guard that may have been removed for the test run.

Retighten all fasteners after several hours of test running. Again, remember to **LOCK OUT THE DRIVE MOTOR** before doing any work on the conveyor. Retighten the fasteners again in one month, at six months (or sooner, if required) and as required thereafter.

KEEP HANDS, FEET AND ALL PARTS OF THE BODY, CLOTHING, AND TOOLS OUT OF THE GRIT WASHER. SERIOUS OR FATAL INJURY CAN OCCUR IN AN INSTANT.

9. Grouting:

After the grit classifier/washer has run for twenty-four hours, verify plumb, level and alignment. Then the grouting may be done. Make any final adjustments to the components that are to be grouted. It is recommended that premixed non-shrinking grout be used. Grout per manufacturer's instructions.

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "SW-CL" GRIT CLASSIFIER/WASHER

START-UP AND SHUTDOWN PROCEDURES

After the equipment has been installed and adjusted in accordance to the installation instructions, the equipment is ready for start-up. Before starting the equipment, it is important that all lubrication procedures have been followed, reducers have been filled to the proper level with oil and all grease fittings have been properly greased. Any tools or other materials that may block proper operation of the equipment should be removed. Any safety guards that have been removed should be returned.

The power to the motors should be checked for the proper voltage. Once the precautions above have been completed, the drive motor can be started. The amperage draw on each motor leg should be read and compared with the motor nameplate data. Carefully check the equipment through several cycles for proper operation. If there is any malfunction of the equipment, check the trouble-shooting guide or consult Schloss Engineered Equipment, Inc.

The equipment can be shut down at any time by turning the **Hand-Off-Auto** selector switch to "Off" or turning the disconnect switch to the off position. The procedure may be different depending on the electrical controls furnished. For extended shutdown procedures, see the section on storage of equipment.

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "SW-CL" GRIT CLASSIFIER/WASHER

OPERATION INSTRUCTIONS

Function:

The Schloss Engineered Equipment, Inc. Type "SW-CL" Grit Classifier/Washer is designed to wash and remove organic matter accumulated with collected inorganic solids and de-water the remaining inorganics (grit). An inclined screw conveyor, settling hopper, and overflow box with adjustable weir accomplish this process. The process also includes a cyclone, which separates material by weight. The cyclone is useful when there are large quantities of organics with the grit.

Process:

The collected grit slurry is fed into the classifier/washer hopper, where settlement occurs. The surface area of the water governs this settlement, the retention time (surface loading rate) in the washer hopper, and the dilution of the slurry.

The effluent weir located on the back of the trough can be adjusted, thus changing the water level within the trough. With a raised weir (and water level) there is more liquid in the trough and a longer retention time. This will allow more fines to settle. Additional wash water may be required for dilution of the liquid to prevent hindered settling due to heavy volume of solids.

Dewatering the settled grit is accomplished by conveying the solids up the inclined screw conveyor.

Results:

Heavy, inorganic grit is settled and classified. Then it is dewatered and removed from the sewage flow. The washed organics are passed back into the sewage flow via the washer's overflow box and piping.

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "SW-CL" GRIT CLASSIFIER/WASHER

SAFETY, LUBRICATION AND MAINTENANCE INSTRUCTIONS

Introduction

A regular maintenance program will help provide long, dependable service. Please refer to the Manufacturer's Data included in later sections of this manual for complete instructions on the lubrication and maintenance of the individual components.

Frequencies listed are for normal operation and conditions. Adjust as required to suit actual service conditions.

An approved equal may substitute lubricants specified. Consult your lubricant supplier for recommendations.

Check nameplates on the drive unit and bearings for correct lubrication.

Note: After the first thirty days of operation, the oil in the gear reducer needs to be drained, flushed and refilled with the proper grade of lubricant per the Manufacturer's Instructions.

Safety

1. Follow all instructions. Learning about the equipment will help make the equipment easier and safer to operate.
2. **ALWAYS LOCK OUT THE DRIVE BEFORE WORKING ON THE EQUIPMENT.** All guards must be in place before operating the equipment.
3. We recommend that handrails, toe plates, warning signs, and cover plates be installed at all times during equipment operation.
4. **KEEP HANDS, FEET, AND ALL PARTS OF THE BODY, CLOTHING, AND TOOLS OUT OF THE GRIT WASHER. SERIOUS OR FATAL INJURY CAN OCCUR IN AN INSTANT.**

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "SW-CL" GRIT CLASSIFIER/WASHER

SAFETY, LUBRICATION AND MAINTENANCE INSTRUCTIONS (cont'd)

Lubrication Schedule

The following lubrication schedule is applicable only after the lubrication required during the initial equipment break-in period has been performed. **ALWAYS LOCK OUT DRIVE** before performing any lubrication or maintenance on this equipment.

Equipment	Lubricant	Frequency
Reducer/Oil-lubricated seals (If provided)	Per Manufacturer's Recommendations	Semi-Annually
Reducer	* Lubricate unit per Manufacturer's Recommendations	Semi-Annually or 2500 hrs
Motor Bearings	Lubricate unit per Manufacturer's Recommendations.	Annually
Tailshaft Bearing	SAE 30 Oil	Annually

* Gear Oil Specification is dependent upon the type of reducer and the actual operating conditions. Heavier oil is normally required during the summer months.

SAFETY, LUBRICATION AND MAINTENANCE INSTRUCTIONS (cont'd)

Maintenance and Inspection

The following maintenance schedule is applicable only after all maintenance required during the initial equipment break-in period has been performed. Refer to Manufacturer's Data for break-in maintenance instructions. **ALWAYS LOCK OUT THE DRIVE** before performing any lubrication or maintenance on this equipment.

Equipment	Procedure	Frequency
All Components	Inspect all parts to observe condition.	Daily
Discharge Chute	Hose off accumulated debris and residue.	Daily
Cyclone	Check for proper operation; clean as required.	Daily
Reducer	Check oil level and breather.	Monthly
Bolts & Fasteners	Check for looseness; Re-tighten as required.	Monthly
Cyclone Apex Valve	Adjust as required; check for wear.	Monthly
Cyclone Liners	Check for wear; replace as required.	Quarterly
Screw Conveyor	Check for wear on flights.	Semi-Annually or as determined by service
Screw Conveyor Tail Shaft Bearing	Check for wear.	Semi-Annually or as determined by service
All Components	Check all parts; clean or replace worn or damaged parts. Touch up any nicks or scratches in paint.	Semi-Annually or Annually or as determined by service

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "SW-CL" GRIT CLASSIFIER/WASHER

TROUBLE SHOOTING GUIDE

The following list of equipment and operational problems and their probable causes is provided to guide the experienced operator in simple troubleshooting. More involved troubleshooting may require a direct call to Schloss Engineered Equipment. Always perform troubleshooting in a logical, orderly manner. Remember, isolation is the key to successful troubleshooting. No troubleshooting guide can have answers to all the problems that may arise. Answers to some problems will only come through experience. **ALWAYS LOCK OUT THE DRIVE WHEN REQUIRED.**

A. Equipment Problems:

1. **Motor will not start:** Check power source for wiring overloads, interlocks, etc. If an overload is encountered, carefully check equipment for jamming before resetting.

2. **Motor overheats:** Check for overloading conditions. Check actual voltage and amperage draw against motor nameplate and heater ratings.

3. **Motor producing unusual noise:** Check bearings for proper lubrication and check sheaves for proper tightness.

4. **Oil leaks around the drive reducer:** Check to see that the fill, drain and breather are in the correct location. Check breather according to Manufacturer's Instructions.

5. **Reducer wobbles:** Check screw conveyor shaft for straightness. Check all fasteners for proper tightness.

6. **Reducer overheats:** Check for quality, type and quantity of oil. Refer to Manufacturer's Instructions.

7. **Drive reducer producing unusual noise and vibrations:** Refer to Manufacturer's Instructions as this may indicate a serious condition requiring immediate attention. Check coupling bolts at the upper end of the screw conveyor.

8. **Screw conveyor producing a dragging noise:** Check for proper clearance with trough. Check for debris lodged between screw conveyor and tank. Check for bent screw.

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "SW-CL" GRIT CLASSIFIER/WASHER

TROUBLE SHOOTING GUIDE (cont'd)

9. **Upper end noise in screw conveyor:** Check coupling bolts, check drive reducer/ screw conveyor interface. Refer to drive section.

10. **Lower end noise in screw conveyor:** Check for proper tail shaft lubrication.

11. **Screw conveyor water spray does not work:** Check water source. Check valves. Check for clogged nozzle.

12. **Cyclone pressure drop at average flow rates is too low:** Change vortex finder to smaller size to increase pressure drop across cyclone.

13. **Cyclone pressure drop at average flow rates is too high:** Change vortex finder to larger size if possible.

14. **Cyclone discharge from apex is in the form of a wide cone:** Apex valve is too large or opened too far. Reduce apex valve opening or replace with smaller unit.

15. **Cyclone discharge from apex is in form of stream or rope:** Apex diameter is too small. Increase apex valve opening or replace with larger unit.

16. **Excessive and oversized grit is reporting to the cyclone overflow:** Apex opening may be too small or siphoning of overflow is taking place. Check apex for proper cone discharge. Check to see that an atmospheric siphon break is installed and is not plugged or capped. Refer to Manufacturer's Instructions.

17. **Cyclone separation or split is not sharp:** Check flow rates, pressure drop, and feed dilution. These should be constant with a maximum of 1% solids in the feed. Refer to Manufacturer's Instructions concerning the proper pump sump design, pump selection and feed dilution.

18. **Cyclone pressure fluctuates excessively:** Check the feed sump pump design to ensure that air is not being entrained into the feed at the pump inlet. Check to see that the flow rate is constant. Refer to Manufacturer's Instructions for further details.

SCHLOSS ENGINEERED EQUIPMENT, INC.

TYPE "SW-CL" GRIT CLASSIFIER/WASHER

TROUBLE SHOOTING GUIDE (cont'd)

B. **Operational Problems:**

1. **Grit will not convey up and out of the grit washer:** Check for excessive spray water that can wash the grit back into the tank. Spray should be adjusted to only wash away excessive organics and fines. Check for hindered settling. Sufficient wash water must be added to the grit washer such that the percent solids- by-weight is very low. However, excessive wash water will cause excessive grit to wash out over the overflow. Check screw rotation.

2. **Grit is too wet:** Adjust weir height. Adjust water spray for optimum cleaning without excessive wetness.

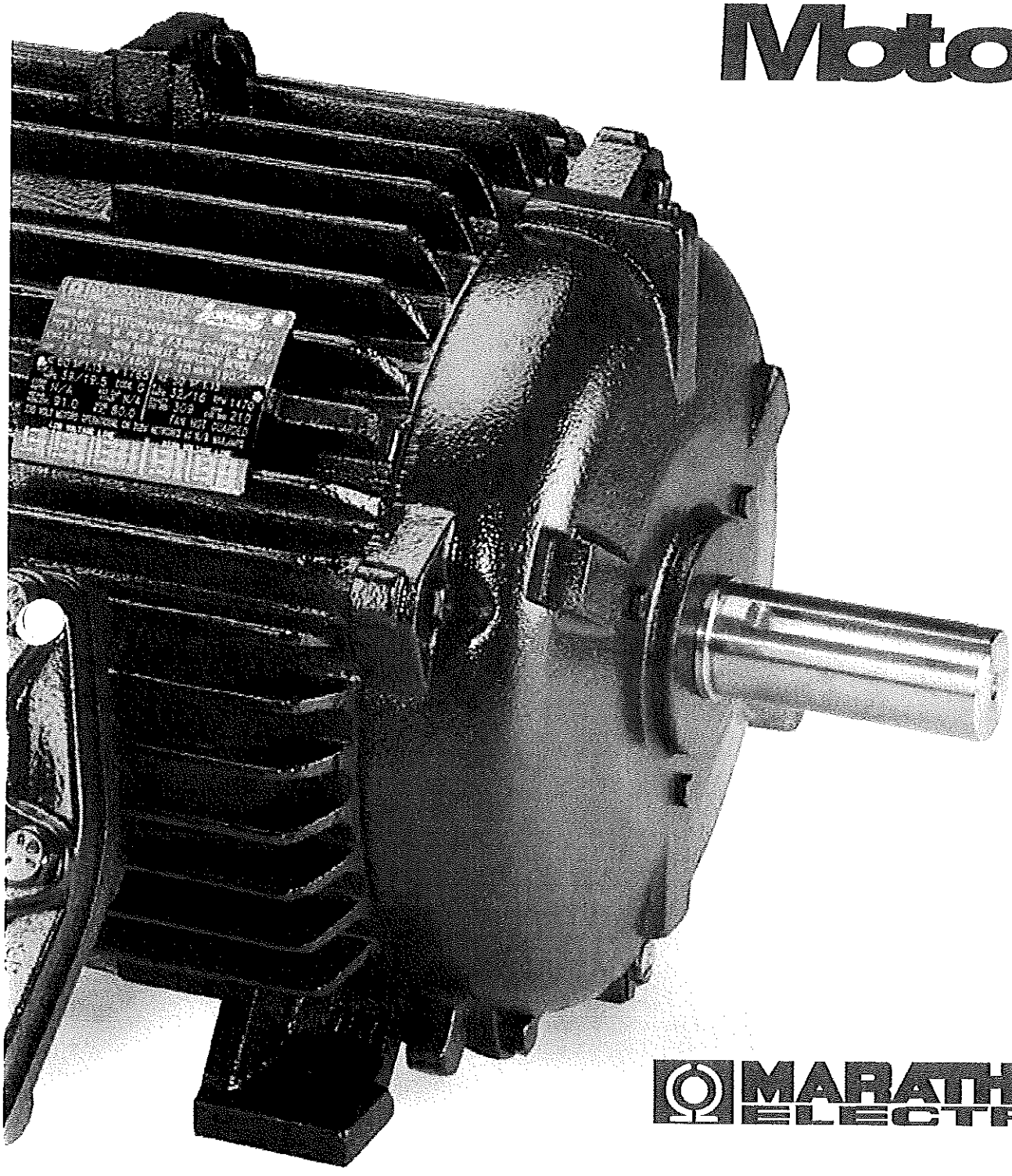
3. **Grit contains excessive organics:** Check apex of cyclone. Adjust wash water and spray water if provided for optimum performance. Adjust level of overflow weir noting cause and effect relationships.

SECTION II

MOTOR

GRIT COLLECTOR

Hazardous Duty Motors



MARATHON® ELECTRIC

Motors for the Long Run!

MARATHON® ELECTRIC

Motors for the Long Run!

Catalog Number: C362A

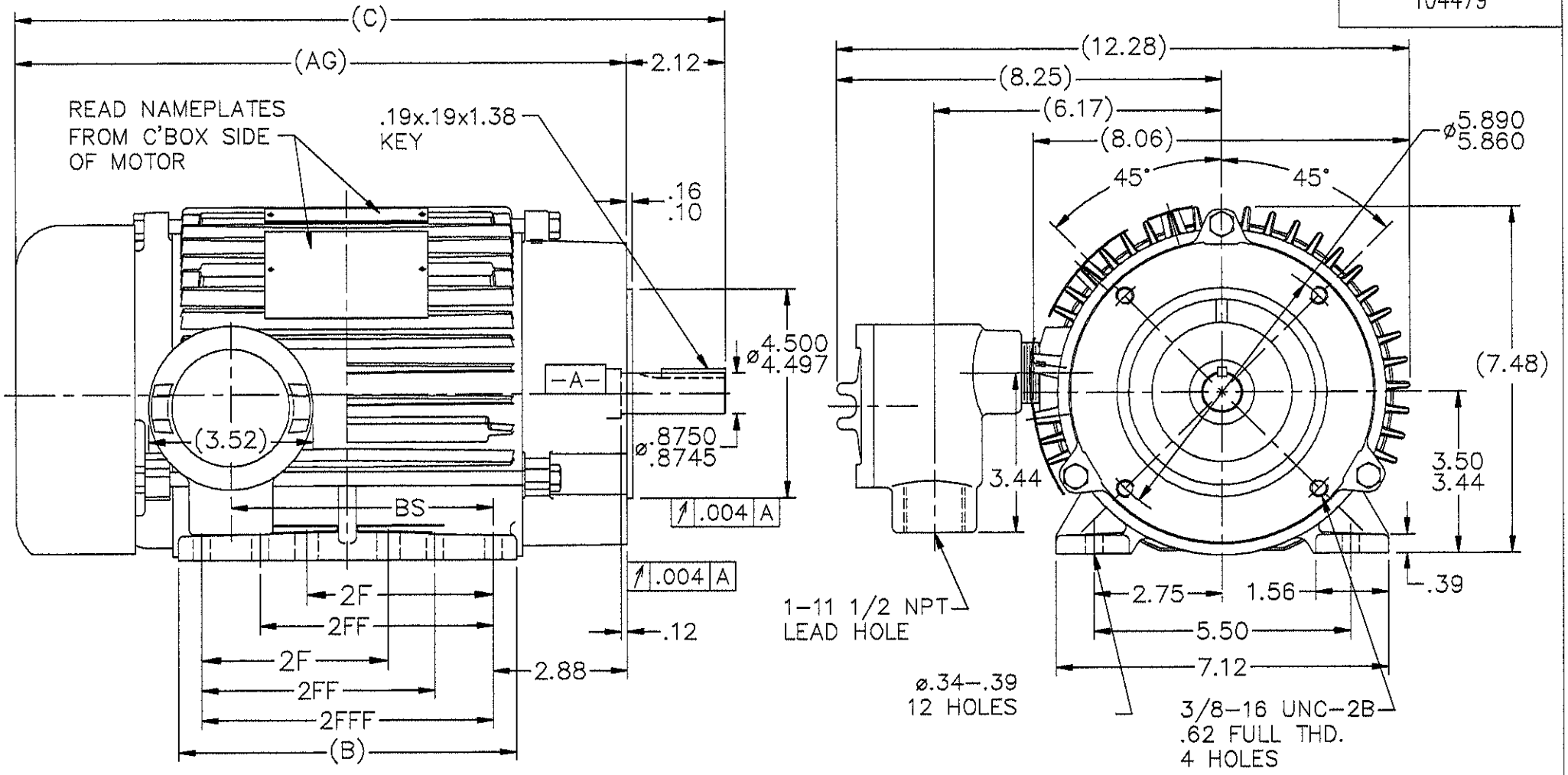
Model Number: 145TTGN6536

******Motor Nameplate Shows 60 and 50 Hertz Information******

60 Hertz				50 Hertz			
HP	1 1/2	**Voltage**	208-230/460	**HP**	1	**Voltage**	190/380
kW	1.12	**FL Amps**	4.7-4.6/2.3	**kW**	.75	**FL Amps**	4.2/2.1
RPM	1800			**RPM**	1500		
FL Eff	86.5 %	**SF**	1.15	**FL Eff**	85 %	**SF**	1.15

Phase	3	**Insulation Class**	F
Frame	145TC	**Duty**	CONTINUOUS
Enclosure	EPFC	**Ambient**	40
Mounting	C-Face Rigid	**NEMA Design**	B
Orientation	HORIZONTAL	**Starting Type**	LINE OR INVERTER
Assembly	F1 ONLY	**KVA Code**	P
Drive End Bearing	BALL	**IP Code**	54
Opposite End Bearing	BALL		
Drive End Bearing Size	6205		
Opposite End Bearing Size	6203	**Hazardous Location**	EXP PROOF CL I GR D CL II GR F&G T3B
Weight	80 LB lbs	**Inverter Speed Range**	CONSTANT 10:1
CE	N	**CSA**	N
UL	UL Listed		
Thermal Protection	Thermostats (Normally Closed)		

104479



NOTE:
1. BOX CAN BE ROTATED IN 90° STEPS.
2. BOX CAN BE MOUNTED ON OPPOSITE SIDE BY REMOVING BRACKETS & TURNING FRAME 180°.

DASH	FR.	C	AG	B	BS	2F	2FF	2FFF
750	143/5 TC	15.23	13.11	7.25	5.62	4.00	5.00	6.25

NO.	REVISION	BY & DATE	CHK
4	UPDATED FRAME PER. ISAAC 11-4672	RFH 11-28-2011	EH
3	REDRAWN IN AUTOCAD	TAT 07-06-2004	ML
2	REVISED DIM. TO SHOW 2F & 2FF CN 27451	HLB 01-14-2001	
1	NEW DRAWING MU21039	BLR 08-13-1998	

TOLERANCES UNLESS SPECIFIED

DEC.	INCHES
.X	±.1
.XX	±.03
.XXX	±.005
.XXXX	±.0005
ANG	±7'30"

MARATHON ELECTRIC

TITLE OUTLINE
140TC FR. – EXP.PR – C' FACE

MAT'L

FINISH

CAD FILE 104479

RFP

DIST WP

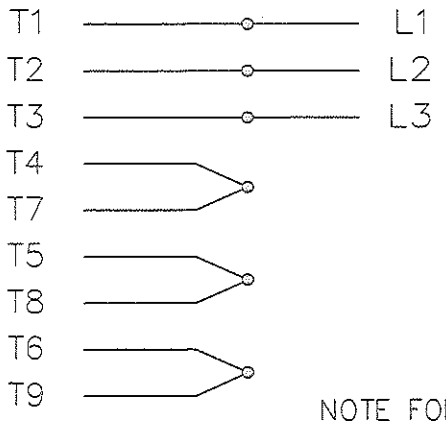
DRAWN	BLR 08-05-1998
CHK	ML 08-10-1998
APPD	MTB 08-13-1998
SCALE	5=16
REF	
FMF	
PREV	

SIZE	DRAWING NO.	PAGE	OF	REV.
A	104479			4

EE7308T

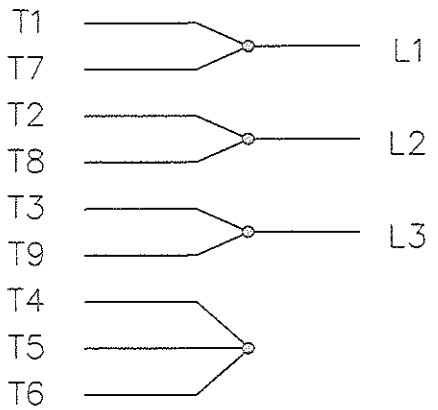
THREE PHASE
DUAL VOLTAGE MOTOR

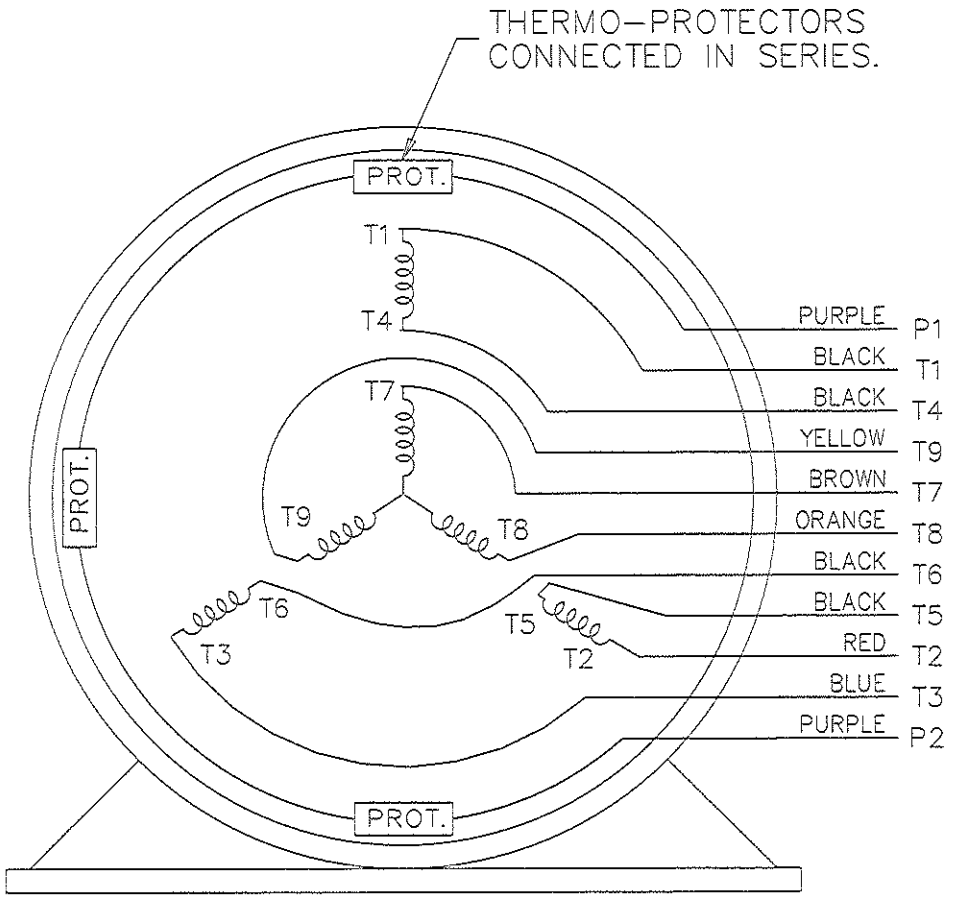
HIGH VOLTAGE



NOTE FOR FACTORY USE ONLY:
TO SURGE TEST FOR COMMON CONNECT:
HIGH VOLT: CONNECT P1 TO T1
THEN P2 TO L1
LOW VOLT: CONNECT P1 TO T1 & T7,
THEN P2 TO L1

LOW VOLTAGE





VIEW OF TERMINAL END

NO.	REVISION	BY & DATE	CHK
11	ADDED COLORS TO "T & P" LEADS CN 40494	MSG 08-08-2006	ML
10	ADDED SURGE TESTER NOTE – FOR FACTORY USE ONLY		
	CN 24255	MH 06-03-1997	
9	REDRAWN	SMC 05-15-1992	

TOLERANCES UNLESS SPECIFIED	
DEC.	INCHES
.X	±.1
.XX	±.02
.XXX	±.005
.XXXX	±.0005
ANG	±7'30"

MARATHON ELECTRIC

TITLE CONNECTION DIAGRAM
3 PHASE – DUAL VOLTAGE MOTOR

MAT'L.

FINISH

DRAWN	SMC 05-13-1992
CHK	ML 05-13-1992
APPD	TB 05-13-1992
SCALE	1=1
REF	
FMF	
PREV	

RFP

DIST WP

CAD FILE EE7308T

SIZE	DRAWING NO.	PAGE	OF	REV.
A	EE7308T			11

9/30/2008 5:36:00 AM

Installation, Operation and Maintenance Instructions

for AC Induction Motors
56- 6800 Frames (NEMA)
63 – 280 Frames (IEC)

A REGAL-BELOIT COMPANY

MARATHON ELECTRIC
Contact Motor Customer Service at:
Phone: (715) 675-3311
www.marathonelectric.com

Form 5554E

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE
OWNER: READ AND SAVE THESE INSTRUCTIONS

SAFETY INSTRUCTIONS

⚠ This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ WARNING
Before installing, using, or servicing this product, carefully read and fully understand the instructions including all warnings, cautions, & safety notice statements. To reduce risk of personal injury, death and/or property damage, follow all instructions for proper motor installation, operation and maintenance.

These instructions are not intended as a complete listing of all details for installation, operation, and maintenance. If you have any questions concerning any of the procedures, STOP, and call the appropriate Regal-Beloit motor company.

Table of Contents

motor is suitable for use on Pulse Width Modulated (PWM) type VFD power. In addition, the nameplate must be marked with the inverter rating; for example, "2:1 CT", "2 to 1 Constant Torque", etc.

1.0 INSTALLER/OWNER/OPERATOR RESPONSIBILITY:

1.1 ELECTRICAL SAFETY

⚠ WARNING: ELECTRICAL SHOCK HAZARD

Electrical connections shall be made by a qualified electrical personnel in accordance with all applicable codes, ordinances and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage. Only qualified personnel who are familiar with the applicable National Code (USA = NEC) and local codes should install or repair electrical motors and their accessories.

⚠ WARNING: ELECTRICAL LIVE CIRCUIT HAZARD

Do not touch electrically live parts. Disconnect, lockout and tag input power supply before installing or servicing motor (includes accessory devices). Use a voltmeter to verify that power is off before contacting conductors.

⚠ WARNING: ELECTRICAL GROUNDING HAZARD

Failure to properly ground motors, per the National Electrical Code (NEC) Article 430 and local codes may cause serious injury or death to personnel. For general information on grounding refer to NEC Article 250. (Also see "Ground Connections section 3.4.4").

⚠ WARNING: AUTOMATIC RESET PROTECTOR HAZARD

Do not use automatic reset protectors if automatically restarting the motor will place personnel or equipment at risk. . Failure to follow this instruction could result in serious personal injury, death and/or property damage

⚠ WARNING: MANUAL RESET PROTECTOR HAZARD

If a tripped manual reset thermal protector is exposed to a temperature less than –7°C (20°F) it may reset and restart the motor automatically. If an application requires a motor with a manual reset thermal protector that will be operated at temperatures less than –7°C (20°F) contact the manufacturer to review the application / motor requirements. Failure to follow this instruction could result in serious personal injury, death and/or property damage

1.2 MECHANICAL SAFETY

⚠ WARNING: LOOSE PARTS HAZARD

Before starting the motor, remove all unused shaft keys and loose rotating parts to prevent them from flying off. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

⚠ WARNING: ROTATING PARTS HAZARD

Keep extremities, hair, jewelry and clothing away from moving parts. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

1.3 ENVIRONMENTAL SAFETY

⚠ WARNING: HAZARDOUS LOCATIONS

(1) The NEC and the local authority having jurisdiction must be consulted concerning the installation and suitability of motors for use in Hazardous Locations. The local authority having jurisdiction must make the final determination of what type of motor is required. The application and operation is beyond the control of the motor manufacturer.
(2) Division 1 Hazardous Locations motors can only be modified or reworked by the manufacturer or a facility that is Listed under UL's category "Motors and Generators, Rebuilt for use in Hazardous Locations". Failure to follow these instructions could result in serious personal injury, death and/or property damage.
(3) Do not use a Hazardous Locations motor with a Variable Frequency Drive (VFD) unless the motor nameplate specifically states that the

2.0 RECEIVING AND INSPECTION

2.1 INITIAL INSPECTIONS

2.1.1 CHECK PACKING LIST AND INSPECT the packaging to make certain no damage has occurred in shipment. If there is visible damage to the packaging, unpack and inspect the motor immediately. Claims for any damage done in shipment must be made by the purchaser against the transportation company.

2.1.2 TURN MOTOR SHAFT by hand to be certain that it rotates freely. Note: Shaft seals and bearing seals may add drag.

2.1.3 CHECK NAMEPLATE for conformance with purchase order requirements and compliance with power supply and control equipment requirements.

2.2 HANDLING:

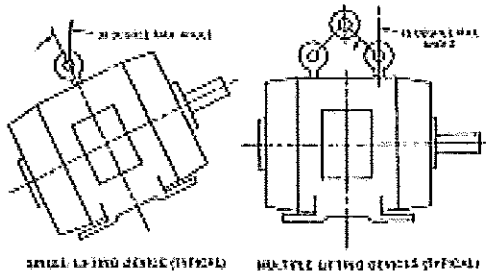
⚠ WARNING: FALLING OBJECT HAZARD

Eyebolts or lifting lugs, where provided, are intended for lifting only the motor and accessories mounted by the motor manufacturer (unless specifically stated otherwise on the motor). Utilizing the motor lifting provision to lift other components such as pumps and gear boxes could result in serious personal injury, death and/or property damage.

⚠ WARNING: FALLING OBJECT HAZARD

Before using the lifting provision, check the eyebolts and/or other lifting means to assure they are not bent or damaged and are completely threaded, seated & secured to the motor. Equipment to lift motor must have adequate lifting capacity. While lifting the motor DO NOT stand under or in the vicinity of the motor. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

2.2.1 LIFTING ANGLE LIMITATIONS



2.3 STORAGE: Motors, not put into service immediately, must be stored indoors in a clean, dry location. Avoid locations with large temperature swings that will result in condensation. Motors must be covered to eliminate airborne dust and dirt. If the storage location exhibits high vibration, place isolation pads under motor to minimize damage to motor bearings.

2.3.1 BEARING LUBRICATION: Bearings are grease packed at the factory; relubrication upon receipt of motor or while in storage is not necessary. If stored more than one year, add grease per lubrication instructions (Table 4-4) before start-up.

2.3.2 SHAFT ROTATION: It is recommended that the motor shaft be rotated 5 to 10 rotations every three months to distribute the grease in the bearings. This will reduce the chance for corrosion to form on the bearing rolling elements and raceways. Note: Shaft seals and bearing seals may add drag.

2.3.3 DAMP OR HUMID STORAGE LOCATIONS: Treat unpainted flanges, shafts, and fittings with a rust inhibitor. Apply appropriate power to the motor's space heaters (if so equipped)

3.0 INSTALLATION AND OPERATION

⚠ **WARNING:** Only qualified personnel who are familiar with the appropriate national code, local codes and sound practices should install or repair electrical motors and their accessories. Installation should conform to the appropriate national code as well as local codes and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

⚠ **WARNING: ELECTRICAL LIVE CIRCUIT HAZARD**
Do not touch electrically live parts. Disconnect, Lockout and Tag input power supply before installing or servicing motor (includes accessory devices). Use a voltmeter to verify that power is off before contacting conductors.

3.1 LOCATION

3.1.1 SELECTING A LOCATION: Consideration should be given to environment and ventilation. Motors should be installed in an area that is protected from direct sunlight, corrosives, harmful gases or liquids, dust, metallic particles, and vibration. A motor with the proper enclosure for the expected operating condition should be selected. Provide accessible clearance for cleaning, repair, service, and inspections (See section 3.1.3 for construction clearances). The location should be considered for possible future motor removal / handling. The free flow of air around the motor should not be obstructed.

3.1.2 AMBIENT TEMPERATURE LIMITS: The ambient temperatures of the air inlet to the motor should not exceed 40°C (104°F) or be less than -30°C (-22°F) unless the motor nameplate specifically states an ambient temperature outside of these limits. The ambient inside an enclosure built around the motor shall not exceed the nameplate ambient. For ambient temperatures outside of these limits consult the motor manufacturer.

⚠ **CAUTION: INSULATION DEGRADATION WARNING**
Insulation at high temperatures ages at an accelerated rate. Each 10°C increase in temperature reduces the insulation life by one half.

⚠ **WARNING: HAZARDOUS LOCATIONS AMBIENT LIMIT:** Division 1 Hazardous Locations motors shall **NOT** be operated below –25°C (-13°F) ambient. (Low temperatures reduce the component mechanical properties.)

3.1.3 CONSTRUCTION SELECTION per LOCATION:

3.1.3.1 DRIPPROOF (OPEN) MOTORS are intended for use indoors where the atmosphere is relatively clean, dry, and non-corrosive. Recommended a minimum clearance of ½ the shaft height between vent openings and the nearest obstruction.

3.1.3.2 TOTALLY ENCLOSED MOTORS are suitable for indoor or outdoor standard service applications.

TEAO or AOM (Totally Enclosed Air Over) motors must be mounted in the air stream. When the motor nameplate states a minimum airflow the motor must be mounted in an air stream meeting this minimum value.

TEFC (Totally Enclosed Fan Cooled) motors must meet a minimum distance of ½ the shaft height between the fan guard grill openings and the nearest obstruction.

3.1.3.3 HAZARDOUS LOCATIONS MOTORS: Hazardous Locations motors are intended for installations in accordance with NEC Article 500. For all installations involving Hazardous Locations motors, consult the applicable national codes, local codes, and the authority having jurisdiction.

Division 1 Installations – Includes Class I & II: Use only motors that are UL Listed and CSA Certified or UL Listed and UL Certified for Canada. These motors bear a separate nameplate that includes the UL Listing Mark and CSA Certification Mark or includes the UL Listing Mark and the UL Mark for Canada. This plate also bears the phrase: " Electric motor for Hazardous Locations" and is marked with the Class, Group and Operating Temperature Code.

Division 2 Installations – Class I only: Use only motors that are CSA Certified and bear the CSA Certification Mark. These motors include a phrase on the main motor nameplate that indicates the motor is CSA Certified for Class I, Division 2 / Zone 2 locations.

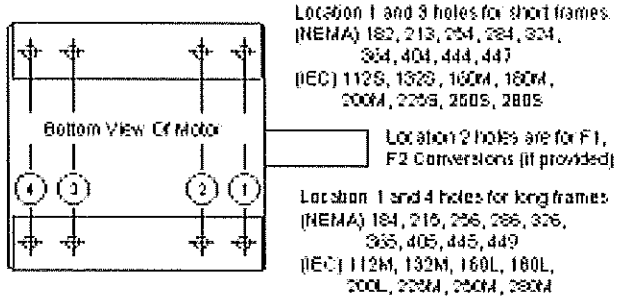
Division 2 Installation – Class II only: Use only Class II motors as described above under "Division I Installations".

⚠ **WARNING: EXPLOSION HAZARD**
A motor should never be placed in an area with a hazardous process or where flammable gases or combustible materials may be present unless it is specifically designed and nameplated for this type of service. Hazardous Locations motors are intended for installations in accordance with NEC Article 500. For all installations involving Hazardous Locations motors, consult the NEC, local codes, and the authority having jurisdiction. Failure to follow these instructions could result in serious personal injury, death and/or property damage. (For other limitations see section 1.3)

3.2 MOUNTING MOTOR:

3.2.1 RIGID BASE (FOOTED): The motor must be securely installed to a rigid foundation or a mounting surface to minimize vibration and maintain alignment between the motor shaft and the load's shaft. The mounting surfaces of the four mounting pads must be flat within 0.01 inches for 210 frame & smaller; 0.015 inches for 250 frame & larger. [IEC 0.25 mm for 130 frame & smaller, 0.38 mm for 160 frame & larger]. This may be accomplished by shims under the motor feet. For special isolation mounting, contact manufacturer for assistance

3.2.2 RIGID BASE HOLE SELECTION -6 OR 8 HOLES



3.2.3 VERTICAL MOUNTING:

CAUTION: ENCLOSURE PROTECTION CAUTION: Most Dripproof rigid base (footed) motors do **NOT** meet "Dripproof" requirements when mounted vertically. If the motor is located in unprotected environments, the addition of a drip cover may be available. Drip covers not available for cast iron rigid base motors.

⚠ **WARNING: FALLING OBJECT HAZARD**
The lifting provision on standard horizontal footed motors is not designed for lifting the motor in a vertical shaft up or shaft down position. (see 2.2.1 lifting angles). Lifting method / provisions for

mounting a rigid base (footed) motor vertically is the responsibility of the installer.

VERTICAL SHAFT DOWN: Most standard horizontal motors thru 449 Fr. (excluding brake motors) can be mounted in a vertical shaft down orientation. For vertical brake motors see section 3.3.6.2.

VERTICAL SHAFT UP:

⚠ **WARNING: HAZARDOUS LOCATIONS VERTICAL MOUNT:** Hazardous locations motors must **NOT** be mounted vertically shaft up without approval by the motor manufacturer. Without proper retaining provisions the rotor may move axially and contact components, creating a spark hazard.

Belted or Radial Load when mounted vertically: The following frame sizes / constructions with applied (axial) down loads within the limit stated are acceptable when mounted vertical shaft up.

Table 3-1 Belted or Radial Load Applications (All speeds)

Frame Size	Enclosure	Construction	Shaft Up OK	Max Applied Down Load[3]
56	TEFC & ODP	Steel	Yes	25 lbs
140	TEFC	Steel & Cast Iron	Yes	25 lbs
	ODP	Steel	Yes	25 lbs
180	TEFC	All	Yes	35 lbs
	ODP	Steel	Yes	35 lbs
210	TEFC	All	Yes	40 lbs
	ODP	Steel	Yes	40 lbs
250	TEFC	All	Yes	40 lbs
	ODP	Steel	Yes	40 lbs
		Cast Iron	No[2]	N/A
280-320	320 TTFC models	Cast Iron	Eng[1]	N/A
	All Other TEFC	Cast Iron & Aluminum	Yes	30 lbs
	ODP	Cast Iron	No[2]	N/A
	TEFC & ODP	Steel	Build Up Only[4]	N/A
360 & Up	TEFC	Cast Iron	Build Up Only[4]	N/A
	ODP	Cast Iron	No[2]	N/A
	TEFC & ODP	Steel	Build Up Only[4]	N/A

Notes:

1 For TEFC model numbers beginning with 324TTFC or 326TTFC consult the motor manufacturer to determine if a build up motor is required.

2 The max applied down load is any applied load external to the motor, including such things as sheave weight, fan loads, axial belt force, pump load, etc. If the application is direct drive with no applied radial load, consult the motor manufacturer.

3 "Build-up only", refers to motors that are specifically ordered and built for shaft up applications. It does not imply that all build-up motors are suitable for shaft up applications.

3.3 APPLICATION ASSEMBLY TO MOTOR:

⚠ **CAUTION: EQUIPMENT DAMAGE:**
Do not connect or couple motor to load until correct rotational direction is established.

3.3.1 GENERAL: PROPER ALIGNMENT of the motor and driven equipment minimizes vibration levels, maximizes bearing life, and extends the overall life of the machinery. Consult the drive or equipment manufacturer for more information.

⚠ **CAUTION: BEARING FAILURE**
During assembly do NOT force components onto the shaft. Striking or hammering the component may result in bearing damage.

3.3.2 DIRECT COUPLING: Use flexible couplings if possible. For applications that apply radial, axial or moment loading on the motor shaft see section 3.3.3.

⚠ **CAUTION: BEARING FAILURE**
Unless approved by the motor manufacturer do **NOT** direct couple a vertical shaft up or roller bearing motor. Direct coupling a vertical shaft up motor or a motor with a roller bearing may result in bearing damage.

3.3.3 DIRECT CONNECTED: Radial loading for direct connected equipment (gears, fans etc.) must be approved by the motor manufacturer unless within the maximum overhung load limits (Table 3-2). Combined loading (axial, radial and/or moments) must be approved by motor manufacturer. For belted loads see section 3.3.4.

Table 3-2 Maximum Radial Load (lbf) @ Middle of the Shaft Extension Length

Frame Number	Motor Rated RPM			
	3600	1800	1200	900
143T	106	166	193	210
145T	109	170	199	218
182T	187	230	261	287
184T	193	237	273	301
213T	319	317	470	510
215T	327	320	480	533
254T	500	631	729	793
256T	510	631	736	820
284T	-	866	990	1100
286T	-	871	1005	1107
324T	-	950	1100	1215
326T	-	950	1113	1230
364T	-	1078	1365	1515
365T	-	1078	1380	1540
404T	-	1388	1590	1762
405T	-	1400	1610	1780
444T	-	1580	1795	2005
445T	-	1520	1795	1985
447T	-	1455	1765	1985
449T	-	1640	1885	2130

Values based on 26,280 hrs B-10 Life
For "End of Shaft" Load multiply value by 0.88
To convert from lbf to N multiply value by 4.4482.

3.3.4 BELTED:

The goal of any belted system is to efficiently transmit the required torque while minimizing the loads on the bearings and shafts of the motor and driven equipment. This can be accomplished by following four basic guidelines:

1. Use the largest practical sheave diameter.
2. Use the fewest number of belts possible.
3. Keep sheaves as close as possible to support bearings.
4. Tension the belts to the lowest tension that will still transmit the required torque without slipping. It is normal for V-belts to squeal initially when line starting a motor

3.3.4.1 Sheave Diameter Guidelines:

In general, smaller sheaves produce greater shaft stress and shaft deflection due to increased belt tension. See Table 3-3 for recommended minimum sheave diameters. Using larger sheaves increases the contact with belts which reduces the number of belts required. It also increases the belt speed, resulting in higher system efficiencies. When selecting sheaves, do not exceed the manufacturer's recommended maximum belt speed, typically 6,500 feet per minute for cast iron sheaves. Determine belt speed by the following formula:

Figure 1

$$\text{BELT SPEED (Ft/min)} = \frac{\textit{Shaft RPM x 3.14 x Sheave Dia (inches)}}{12}$$

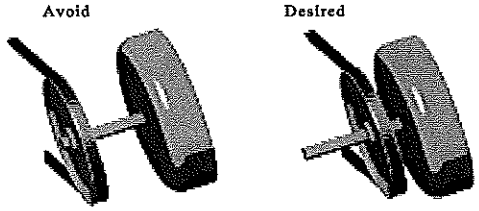
3.3.4.2 Number of Belts

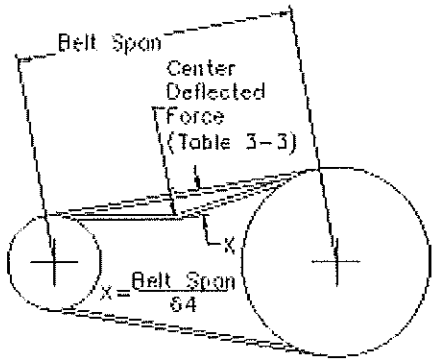
In general, use the fewest number of belts that will transmit the required torque without slipping. See Table 3-3 for recommended maximum number of belts. Each belt adds to the tension in the system, which increases load on the shafts and bearings. Belts are most efficient when operated at or near their rated horsepower.
If the sheaves have more grooves than the number of belts required, use the grooves closest to the motor.

3.3.4.3 Sheave Location

Install sheaves as close to the housing as possible to increase the bearing life of the motor and driven equipment

Figure 2





3.3.4.4 Belt Tension

⚠ CAUTION: Equipment Failure Caution
Belt tensioning by feel is **NOT** acceptable. Tensioning by "feel" can be very misleading, and can damage motor and equipment.
It is normal for V-belts to squeal initially when line starting a motor.

In general, belt tensions should be kept as loose as possible while still transmitting the required torque without slipping. Belt tensions must be measured with a belt tension gage. These inexpensive gages may be obtained through belt manufacturers, or distributors.

Proper belt tension is determined by measuring the force required to deflect the center of the belt a given distance. The proper deflection (in inches) is determined by dividing the belt span in inches by 64. Calculate the proper deflection and then see Table 3-3 for the required "Deflected Force" to achieve that deflection.
After tensioning the belt, rotate the sheaves for several rotations or operate the system for a few minutes to seat belts into the grooves, then re-tension the belts. New belts will stretch during use, and should be retensioned after the first eight hours of use.

Table 3-3 Recommended Minimum Sheave Diameters, Belt Type, Number of Belts and Deflected Force

Motor Hp	1200 rpm				1800 rpm				3600 rpm			
	Min Sheave Dia (in)	Belt Type	Max # of Belts	Avg. Deflected Force (lbs)	Min Sheave Dia (in)	Belt Type	Max # of Belts	Avg. Deflected Force (lbs)	Min Sheave Dia (in)	Belt Type	Max # of Belts	Avg. Deflected Force (lbs)
0.75	2.2	3VX	1	3.1	2.2	3VX	1	3.2	2.2	3VX	1	1.2
1	2.4	3VX	1	4.0	2.2	3VX	1	3.1	2.2	3VX	1	1.6
1.5	2.4	3VX	2	3.1	2.4	3VX	2	2.1	2.2	3VX	1	2.5
2	2.4	3VX	3	2.8	2.4	3VX	2	2.9	2.4	3VX	1	2.7
3	3.0	3VX	2	3.3	2.4	3VX	3	2.9	2.4	3VX	2	2.3
5	3.0	3VX	3	4.0	3.0	3VX	3	3.7	2.4	3VX	3	2.5
7.5	3.8	3VX	4	4.7	3.0	3VX	4	4.1	3.0	3VX	2	4.2
10	4.4	3VX	4	5.4	3.8	3VX	4	4.3	3.0	3VX	3	3.8
15	4.4	3VX	5	5.4	4.4	3VX	4	5.4	3.8	3VX	3	4.4
20	5.2	3VX	6	6.0	4.4	3VX	6	4.8	4.4	3VX	3	5.0
25	6.0	3VX	7	5.6	4.4	3VX	7	5.2	4.4	3VX	4	4.7
30	6.8	3VX	7	5.9	5.2	3VX	7	5.3				
40	6.8	5VX	4	11.6	6.0	3VX	7	6.0				
50	8.2	5VX	4	14.6	6.8	3VX	8	5.9				
60	8.2	5VX	5	14.1	7.4	5VX	4	13.3				
75	10.0	5VX	5	14.5	8.6	5VX	4	14.3				
100	10.0	5VX	6	16.0	8.6	5VX	6	13				
125	12.0	5V	7	14.1	10.5	5V	6	13.1				
150	13.2	5V	7	15.4	10.5	5V	7	13.4				
200	15.0	5V	8	16.0	13.2	5V	8	13.1				
250	15.0	8V	6	27.6	14.0	5V	9	13.8				
300	16.0	8V	7	27.1	14.0	5V/8V	11 / 7	23.4				
350	16.5	8V	7	30.3	14.5	5V/8V	12 / 7	26.0				
400	17.5	8V	8	29.1	15.0	5V/8V	13 / 8	25.7				
450	18	8V	8	31.6	16.0	5V/8V	14 / 9	25.2				
500	18.5	8V	9	30.7	16.5	5V/8V	15 / 9	26.9				
600					17.5	8V	11	26.3				
700					19.0	8V	12	27.3				
800					20.0	8V	13	28.2				

Contact Motor Manufacturer when Belting 3600 rpm Motors Greater than 25 HP

Notes:

1. Horsepower is the nameplate motor horsepower, and RPM is the motor (driver) speed.
2. Minimum sheave diameters are from NEMA standards where applicable.
3. **For variable speed applications or values outside these recommendations, consult motor manufacturer.**
4. Selections are based on a 1.4 service factor, 5 to 1 speed ratio and various Power Transmission Manufacturers' catalogs.
5. These selections are for Narrow V-belt sections only. Consult manufacturer for details on conventional V-belt sections (A, B, C, D and E), or other belt types.
6. "Average Deflected Force is per section 3.3.4.4 of this document and is the force required to deflect the center of a belt 1/64 of the belt span distance. Tolerance on this force is ±1 lbf for forces ≤10 lbs, and ±2 lbs for forces >10 lbs as measured utilizing a belt tension gage.
7. When more than one belt is required the belts must be a matched set (matched for length).
8. If possible, the lower side of the belt should be the driving side to increase the length of wrap on the sheave).
9. For belted loads do not exceed 125% of 60 Hz operating RPM.

3.3.5 VFD (Variable Frequency Drives) OPERATION:

⚠ WARNING: VFD Motors with Reset Thermal Protectors
UL Recognition, UL Listing, or CSA certification does not apply to motors that are equipped with a manual or automatic reset thermal protector when the motor is operated on VFD power.

⚠ WARNING: Power Factor Correction Capacitors:
Power factor correction capacitors should never be installed between the drive and the motor.

⚠ CAUTION: VFD / Motor Setup:
It is the responsibility of the startup personnel during set up of the VFD / motor system to properly tune the drive to the motor for the specific application per the VFD user manual. The correct voltage boost and volts per hertz settings are application dependent and unique to each motor design. Failure to connect over temperature devices (when provided) will void the warranty.

3.3.5.1 Overspeed Capability:

Belted loads: Do not exceed 125% of 60 Hz operating RPM.

Table 3-4 Maximum Safe Continuous Speed (RPM) For Coupled and Direct Connected Loads

NEMA / [IEC] Frame Size	2-Pole	4, 6, or 8 Pole
56-180 [80-110]	7200 *	5400 *
210-250 [130-160]	5400 *	4200*
280 [180]	5400 *	3600
320 [200]	4500 *	3600
360 [225]	4500 *	2700
400-440 [250-280]	3600	2700
>440 [>280]	3600	1800

* = Fan cooled motors (Totally Enclosed & Hazardous Locations Motors) are limited to a maximum safe continuous speed of 4000 RPM **For higher speeds or shortened duty cycle contact motor manufacturer**

3.3.5.2 Cable Lengths: For optimum insulation life, limit VFD to motor cable lengths of general purpose motors

to Table 3-5 values. Definite purpose VFD motors may accommodate longer cable lengths. For additional information contact motor manufacturer.

Table 3-5 Max Cable Lengths General Purpose Motors
These values are based on 3 kHz carrier frequency. Add suitable VFD output-side filters when exceeding the listed values.

Frame Size	230V	460 V	575 V
NEMA 56-320	600 ft.	125 ft.	40 ft.
NEMA 360-5011	1000 ft.	225 ft.	60 ft.
IEC 80-200	180 m.	40 m.	12 m.
IEC 225-280.	300 m.	70 m.	18 m.

3.3.5.3 VFD Grounding: Equipment grounding conductors may be run in the same conduit as the AC motor power leads. This wire must be used as the equipment ground for the motor and not as the fourth current carrying wire of a "WYE" motor circuit. The grounded metal conduit carrying the output power conductors can provide EMI shielding, but the conduit does not provide an adequate ground for the motor; a separate grounding conductor must be used. Grounding the motor neutral (WYE) of a VFD powered motor may result in a VFD ground fault trip. Improper grounding of an inverter fed motor may result in frame voltages in excess of 500 Volts. Refer to Grounding section 3.4.4

3.3.5.4 VFD – Single Phase:

CAUTION: SINGLE PHASE MOTOR FAILURE:
Single Phase motors are **NOT** suitable for use on VFD power. Connecting a Single Phase Motor to a VFD voids the warranty.

3.3.5.5 Stray Voltage on Accessory Leads:

VFD's will couple stray (common-mode) voltage to motor-mounted RTDs, thermistors, thermostats and space heaters. The leads of these elements must be properly insulated and control input circuits must be designed to withstand this common-mode voltage.

3.3.6 ACCESSORIES / PROVISIONS:

3.3.6.1 General: Carefully read and understand the accessory manufacturer's instructions, supplied with motor. Contact the manufacturer for additional information.

3.3.6.2 Brake Motors:

⚠ CAUTION: Vertical Motor Premature Brake Failure
Motors with brakes that are designed for vertical applications are equipped with springs to support the brake pressure plate. Mounting a horizontal brake motor vertically shaft up or down may require a pressure plate spring modification. Failure to modify the brake for the vertical application may result in premature brake failure. If in question, consult brake literature or brake manufacturer.

Brake Solenoid Wiring: Do NOT connect the brake solenoid to the output of a VFD. The brake solenoids must be wired to 50/60 Hz line power

3.3.6.3 Space Heaters:

Motors provided with space heaters have two leads that are brought into the conduit box or into an auxiliary box. These leads are marked "H1", "H2" ("H3", "H4" if a second space heater is supplied). See the space heater nameplate on motor for heater rating.

⚠ WARNING: DIVISION 2 EXPLOSION HAZARD
The space heater temperature rating when used in Class I, Division 2 motors shall **NOT** exceed 80% of the auto ignition temperature of the hazardous gas or vapor. See the space heater nameplate on motor for heater Temperature Code and heater rating. Failure to follow this instruction could result in serious personal injury, death and/or property damage

3.3.6.4 Thermal Protection:

General Information: When thermal protection is provided, one of the following will be stamped on the nameplate:

1. **"THERMALLY PROTECTED"** This motor has built in thermal protection. Thermal protectors open the motor circuit electrically when the motor overheats or is overloaded. The protector cannot be reset until the motor cools. If the protector is automatic, it will reset itself. If the protector is manual, disconnect motor from power supply. After protector cools (five minutes or more) press the reset button and reapply power to the motor. In some cases a motor is marked "Auto" and the connection diagram on the motor will identify T'Stat leads – see "2 " below. (See warnings on Manual and Automatic reset protectors - section 1.1)

2. **"WITH OVERHEAT PROTECTIVE DEVICE"**: This motor is provided with an overheat protective device that does not directly open the motor circuit. Motors nameplated with this phrase have either thermostats, thermisters or RTD's. The leads to these devices are routed into the motor conduit box or into an auxiliary box. The lead markings are defined on the nameplate (normally "P1", "P2") . The circuit controlled by the overheat protection device must be limited to a maximum of 600 volts and 360 volt-amps. See connection decal provided inside the terminal box cover. Failure to connect these over temperature devices (when provided) will void the warranty.

   ⚠ WARNING: EXPLOSION HAZARD
   For Hazardous Locations motors provided with thermostats UL and the NEC require connection of thermostat leads into the control portion of a manual reset start circuit. Failure to follow this instruction could result in serious personal injury, death and/or property damage

Resistance Temperature Detectors (RTD): When winding and/or bearing RTDs are provided the RTD lead markings are defined on the nameplate. (Normally "R1", "R2", "R3" etc.)

3.3.6.5 RTD Alarm & Trip Settings:

Tables 3-6 & 3-7 are suggested initial RTD alarm and trip settings. For motors found to operate significantly below these values the settings may be reduced accordingly.

Table 3-6 Winding RTD – Temperature Limit (°C) 40 °C Max Ambient

Motor Load	Class B Temp Rise≤ 80°C		Class F Temp Rise≤ 105°C	
	Alarm	Trip	Alarm	Trip
Up to 1.0 SF	130	140	155	165
>1.0 to 1.15 SF	140	150	160	165

Table 3-7 Bearing RTD – Temperature Limit (°C) 40 °C Max Ambient

Ambient	Alarm	Trip
Up to 40°C	95	100
> 40°C	110	115
Bearings that are Heat Stabilized to 150 °C	130	135

3.3.7 GUARDS:

⚠ WARNING: ROTATING PARTS HAZARD
When devices are assembled to the motor shaft, be sure to install protective devices such as belt guards, chain guards, and shaft covers. These devices must protect against accidental contact with extremities, hair, and clothing. Consider the application and provide guarding to protect personnel. Remove all unused shaft keys and loose rotating parts to prevent them from flying off and causing bodily injury. Failure to follow this warning could result in serious personal injury, death and/or property damage.

3.4 ELECTRICAL CONNECTIONS:

⚠ WARNING: ELECTRICAL HAZARDS
Before proceeding read Section 1-1 on Electrical Safety. Failure to follow the instructions in Section 1-1 could result in serious personal injury, death and/or property damage

3.4.1 POWER SUPPLY / BRANCH CIRCUIT

⚠ WARNING: POWER SUPPLY INCOMPATIBILITY HAZARD
Check power supply to make certain that voltage, frequency and current carrying capacity are in accordance with the motor nameplate. Failure to match motor nameplate values could result in serious personal injury, death and/or property damage

⚠ WARNING: BRANCH CIRCUIT SUPPLY HAZARD
Motor and control wiring, fusing, overload protection, disconnects, accessories and grounding must always conform to the applicable electrical codes as well as local codes and sound practices.

3.4.1.1 Branch Circuit Supply to a motor should include a disconnect switch, short circuit current fuse or breaker protection, motor starter (controller) and correctly sized thermal elements or overload relay protection.

3.4.1.2 Fuses, Breakers, Overload Relays

Short Circuit Current Fuses or Breakers are for the protection of the branch circuit. Starter or motor controller overload relays are for the protection of the motor. Each of these should be properly sized and installed per the applicable electrical codes as well as local codes and practices.

⚠ WARNING: PROTECTIVE DEVICE DISABLED HAZARD
DO NOT bypass or disable protective devices. Protection removal could result in serious personal injury, death and/or property damage

3.4.1.3 AC Power Supply Limits

Motors are designed to operate within the following limits at the motor terminals:
1- AC power is within +/- 10 % of rated voltage with rated frequency applied. (Verify with nameplate ratings) **OR**
2- AC power is within +/- 5% of rated frequency with rated voltage **OR**
3- A combined variation in voltage and frequency of +/- 10% (sum of absolute values) of rated values, provided the frequency variation does not exceed +/-5% of rated frequency.
4- For 3 phase motors the line to line full load voltage must be balanced within 1%.
5- If the motor is rated 208-230V, the voltage deviations must be calculated from 230V.

CAUTION: Reduced Motor Performance
Operation outside of these limits will degrade motor performance and increase operating temperature.

3.4.2 TERMINAL BOX:

3.4.2.1 Conduit Opening: For ease of connections, motors are typically provided with large terminal boxes. Most motors have conduit access in 90 degree increments, the terminal box conduit opening is typically provided via knockouts, holes with covers, or the terminal box is rotate-able. Fabricated conduit boxes may have a removable plate for the installer to provide correctly sized hole(s).

3.4.2.2 Hazardous Locations Motors:

⚠ WARNING: EXPLOSION HAZARDS
(1) Terminal Boxes mounted to motor with a pipe nipple: If a pipe nipple mounted terminal box is removed or rotated it must be reassembled with a minimum of five full threads of engagement.
(2) Component Removal: Do not set a terminal box component on its machined surfaces. Prior to component reassembly wipe clean all machined surfaces.
(3) Machined Surface Gap (Hazardous Locations Terminal Boxes): The gap between mating surfaces with the machined terminal box MUST BE LESS THAN 0.002 inches. This gap must be checked with a feeler gage along the entire perimeter. If there is visible damage to the mating surfaces, or if the gap between these surfaces exceeds 0.002 inches, DO NOT complete the installation and contact the motor manufacturer. Failure to follow these instructions could result in serious personal injury, death and/or property damage

3.4.3 LEAD CONNECTIONS

Electrical connections to be made per nameplate connection diagram or separate connection plate. In making connections follow the applicable electrical code as well as local codes and practices.

⚠ WARNING: ELECTRICAL CONNECTION HAZARD
Failure to correctly connect the motor leads and grounding conductor can result in injury or death. Motor lead connections can short and cause damage or injury if not well secured and insulated.

3.4.3.1 Wire Size (Single Phase) Requirements

The minimum wire size for Single Phase, 115 & 230 Volt Circuits must meet table 3-8 for a given distance between motor and either Fuse or Meter Box.

Table 3-8 Minimum Wire Gage Size Single Phase 115 & 230 Volt Circuits

	Distance (Feet) - Motor to Fuse or Meter Box							
Motor	100 Ft.		200 Ft.		300 Ft.		500 Ft.	
HP	115	230	115	230	115	230	115	230
1/4	14	14	10	12	8	10	6	8
1/3	12	14	10	12	6	10	4	8
1/2	10	12	8	10	6	8	4	6
3/4	10	12	6	10	4	8	2	6
1	8	10	6	8	4	6		4
1 1/2	4	10	0	8		6		4
2		8		6		4		2
3		8		6		4		2
5		6		4		2		0

3.4.3.2 Extension Cords (Single Phase Motors):

Where an extension cord(s) is utilized to provide power to the motor the extension cord(s) must be...(1) the proper gauge size per table 3-8, (2) in good working condition (3) properly grounded.

3.4.4 GROUND CONNECTION(S):

⚠ WARNING: ELECTRICAL GROUNDING HAZARD
For general information on grounding (USA) refer to NEC Article 250. Improper grounding of an inverter fed motor may result in frame voltages in excess of 500 Volts. In making the ground connection, the installer must make certain that a good electrical connection is obtained between motor and grounding lead. Failure to properly ground motors, per the applicable national code (such as NEC Article 430) and local codes may cause serious injury or death to personnel.

Primary "Internal" Ground: A grounding conductor must be connected to the grounding terminal provided in the terminal housing. This grounding terminal is either a ground screw, ground lug, or a tapped hole to be used with a separately provided ground screw. The internal grounding feature is accessible inside the terminal housing and must be used as the primary grounding connection.
Secondary "External" Ground: Some motors are provided with a supplemental grounding terminal located on the external surface of the motor frame or feet. This external terminal is for supplemental bonding connections where local codes permit or require such connection

3.4.5 START UP:

⚠ WARNING: ELECTRICAL SHOCK HAZARD:
Be certain that all connections are secure and the conduit box cover is fastened in place before electrical power is connected. Failure to follow these instructions could result in serious personal injury, death, and/or property damage.

⚠ WARNING: LOOSE & ROTATING PARTS HAZARD
Before proceeding read Section 1-2 on Mechanical Safety. Failure to follow the instructions in Section 1-2 could result in serious personal injury, death and/or property damage

⚠ WARNING: EXCESSIVE SURFACE TEMPERATURE HAZARD
Motors with the temperature code stated on the nameplate are designed to operate within this limit. Improper application or operation can cause the maximum surface temperature to be exceeded. A motor operated in a Hazardous Location that exceeds this surface temperature limit increases the potential of igniting hazardous materials. *Therefore, motor selection, installation, operation, and maintenance must be carefully considered to ensure against the following conditions:* (1) Motor load exceeds service factor value, (2) Ambient temperature above nameplate value, (3) Voltages outside of limits (3.4.1.3), (4) Loss of proper ventilation, (5) VFD operation exceeding motor nameplate rating, (6) Altitude above 3300 feet / 1000 meters, (7) Severe duty cycles, (8) Repeated starts, (9) Motor stall, (10) Motor reversing, and (10) Single phase operation. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

⚠ CAUTION: HOT SURFACE
Normal motor surface temperatures may exceed 90 ° C (194° F). Touching the motor frame may cause discomfort or injury. Surface temperatures should only be measured with suitable instruments and not estimated by hand touch.

3.4.5.1 Start Up - No Load Procedure

1. **Check Instructions:** Before startup carefully read and fully understand these instructions including all warnings, cautions, and safety notice statements.
2. **Motor out of storage after more than three months:** Check winding insulation integrity with a Megger. If winding resistance to ground is less than 1.5 Meg-ohms consult the local authorized service shop before energizing the motor.
3. **Check Installation: Mechanical** - Check tightness of all bolts and nuts. Manually rotate the motor shaft to ensure motor shaft rotates freely. Note: Shaft & bearing seals will add drag.
   Electrical - Inspect all electrical connections for proper terminations, clearance, mechanical tightness and electrical continuity. Be sure to verify connections are made per the nameplate connection diagram or separate connection plate. Replace all panels and covers that were removed during installation before energizing the motor.
4. **Energize Motor: Check Rotation**
   If practical check motor rotation before coupling to the load. Unlock the electrical system. Momentarily provide power to motor to verify direction of rotation. If opposite rotation is required, lock out power before reconnecting motor. If motor has a rotational arrow only operate the motor in the rotation identified. Reapply power to ensure proper operation.
5. **Record No Load Amps, Watts & Voltage:**
   Recommend - To establish a baseline value check and record the no load amps, watts, and voltage.

3.4.5.2 Start Up – Load Connected Procedure

1. **Check Instructions:** Before startup carefully read and fully understand these instructions including all warnings, cautions, & safety notice statements.
2. **Coupling Installation:** Check that the connected equipment is properly aligned and not binding. Check that all guards and protective devices are properly installed.
3. **Energize Motor:** When all personnel are clear of the machine, apply power and verify that the load is not transmitting excessive vibration back to the motor though the shaft or the foundation. Verify that motor amps are within nameplate rating. For repeated starts see 3.4.5.3. The equipment can now be fully loaded and operated within specified limits as stated on the nameplate.

3.4.5.3 Jogging and/or Repeated Starts

Do not start more than twice in succession under full load. Repeated starts and/or jogs of induction motors can cause overheating and immediate failure. Contact the motor manufacturer if it is necessary to repeatedly start or jog the motor.

4.0 MAINTENANCE:

⚠ WARNING: Hazardous Locations Motor Repair HAZARD:
Division 1 Hazardous Locations motors can only be modified or repaired by the manufacturer or a facility that is Listed under UL's category "Motors and Generators, Rebuilt for use in Hazardous Locations". Failure to follow these instructions could result in serious personal injury, death and/or property damage.

⚠ WARNING: ELECTRICAL SHOCK HAZARD
Electrical connections are to be made by qualified electrical personnel in accordance with all applicable codes, ordinances and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage. Only qualified personnel who are familiar with the applicable national codes, local codes and sound practices should install or repair electric motors and their accessories.

⚠ WARNING: ELECTRICAL LIVE CIRCUIT HAZARD
Do not touch electrically live parts. Disconnect, lockout and tag input power supply before installing or servicing motor (includes accessory devices).

4.1 GENERAL INSPECTION

Inspect the motor approximately every 500 hours of operation or every three months, whichever occurs first. Keep the motor clean and the ventilation and fin openings clear. The following steps should be performed at each inspection:

4.1.1 VENTILATION: Check that the ventilation openings and/or exterior of the motor is free of dirt, oil, grease, water, etc, which can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.

4.1.2 INSULATION: Use a "Megger" periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. If winding resistance to ground is less than 1.5 Meg-ohms consult the local authorized service shop before re-energizing the motor.

4.1.3 ELECTRICAL CONNECTIONS: Check all electrical connectors to be sure that they are tight.

4.2 LUBRICATION & BEARINGS:

The lubricating ability of grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Longer bearing life can be obtained if the listed recommendations are followed:

NOTE: If lubrication instructions are provided on the motor nameplate, the nameplate instructions will supersede these instructions. Motors marked "Permanently Lubricated" do not require additional service.

⚠ CAUTION: BEARING / MOTOR DAMAGE WARNING
Lubricant should be added at a steady moderate pressure. If added under heavy pressure bearing shield(s) may collapse. Over greasing bearings greatly increases bearing friction and can cause premature bearing and/or motor failure.

4.2.1 GREASE TYPE (unless nameplate states otherwise):
Nameplate Ambient Temperature between -30°C (-22°F) to 65°C (150°F) inclusive: Recommended grease for standard service conditions is Mobil Polyrex ® EM. Equivalent and compatible greases include: Texaco Polystar RB, Rykon Premium #2, Pennzoil Pen 2 Lube, Chevron SRI & Mobil SHC 100.

Nameplate Ambient Temperature below -30°C (-22°F): Special low temperature grease is recommended, such as Aeroshell 7 or Beacon 325 for ball bearings and Mobil SHC 100 for roller bearings.

Nameplate Ambient Temperature above 65°C (150°F): Dow Corning DC44 or equivalent, a special high temperature grease is required. Note that Dow Corning DC44 grease does not mix with other grease types.

For RTD settings see Table 3-7.

4.2.2 BEARING OPERATING TEMPERATURE:

⚠ CAUTION: HOT SURFACE

The external surface temperature of the end shield (bracket) bearing hub may reach 100° C (212° F) during normal operation. Touching this surface may cause discomfort or injury. Surface temperatures should only be measured with suitable instruments and not estimated by hand touch.

4.2.3 LUBRICATION INTERVALS: (For motors with regreasing provisions)

Eq. 4.2 Lubrication Interval = [(Table 4-1) hrs] x [Interval Multiplier (Table 4-2)] x [Construction Multiplier (Table 4-3)]

Table 4-1 Lubrication Intervals (Hours) These values are based on average use.

NEMA / [IEC] Frame Size	Operating Speed – RPM (See Table 3.4 for Maximum Operating Speed)					
	<7200	<5400	<4500	<3600	<1800	<1200
56-180 [80-110]	2500 Hrs.	4000 Hrs	5000 Hrs	6000 Hrs.	17000 Hrs.	20000 Hrs.
210-250 [130-160]		2500 Hrs	4000 Hrs	5000 Hrs.	12000 Hrs.	16000 Hrs.
280 [180]		2000 Hrs	3000 Hrs	4000 Hrs.	10000 Hrs.	14000 Hrs.
320 [200]			2000 Hrs	3000 Hrs.	9000 Hrs.	12000 Hrs.
360 [225]			1500 Hrs	2000 Hrs.	8000 Hrs.	10000 Hrs.
400-440 [250 – 280]				1500 Hrs.	4000 Hrs.	7000 Hrs.
>440 [>280]				1000 Hrs.	3000 Hrs.	5000 Hrs.

Seasonal Service: If motor remains idle for more than six months, Lubricate at the beginning of the season, then follow lubrication interval.

Do not exceed maximum safe operating speed Table 3-4 without manufacturer's approval

Table 4-2 Service Conditions

Use highest level Multiplier: Maximum Ambient Temperature and Contamination are independent factors

Severity of Service	Maximum Ambient Temperature	Atmospheric Contamination	Multiplier
Standard	Less than 40° C (104° F)	Clean, Slight Corrosion, indoors, less than 16 hrs per day	1.0
Severe	Above 40° C (104° F) to 50° C	Moderate dirt or Corrosion or outdoors or more than 16 hrs per day	0.5
Extreme	Greater than 50° C or Class H Insulation	Severe dirt or Abrasive dust or Corrosion	0.2

Table 4-3 Construction Multiplier

Construction	Multiplier
Angular Contact or Roller Bearing	0.5
Vertical Motor	0.5
All others	1.0

Table 4-4 Relubrication Amounts

Frame Size		Volume		
NEMA	IEC	Cu. In.	Fluid oz	ml
48-56	80	0.25	0.14	4.0
143-145	90	0.25	0.14	4.0
182-184	110	0.50	0.28	8.0
213-215	130	0.75	0.42	12.5
254-256	160	1.00	0.55	16.0
284-286	180	1.50	0.83	25.0
324-326	200	2.00	1.11	33.0
364-365	225	3.00	1.66	50.0
404-405	250	3.80	2.11	62.0
444-449	280	4.10	2.27	67.0
>449	>280	4.50	2.50	74.0

For regreasing while operating multiply volume by 125%.

4.2.4 LUBRICATION PROCEDURE: (For Motors with Regreasing Provisions)

CAUTION: BEARING DAMAGE WARNING
Added grease must be compatible with the original equipment's grease. If a grease other than those stated in 4.2.1 is to be utilized contact the motor manufacturer. Nameplate information supersedes section 4.2.1 (GREASE TYPE). New grease must be free of dirt. Failure to follow these instructions and procedure below may result in bearing and/or motor damage.

For an extremely dirty environment, contact the motor manufacturer for additional information.

LUBRICATION PROCEDURE:

1. Clean the grease inlet plug or zerk fittings prior to regreasing.
2. (If present) Remove grease drain plug and clear outlet hole blockage.

CAUTION: GREASE DRAIN PLUGGED:
Old grease may completely block the drain opening and must be mechanically removed prior to regreasing. Forcing a blocked drain open by increased greasing pressure may collapse bearing shields and / or force excess grease through the bearings and into the motor.

3. Add grease per Table 4-4
4. Re-install grease inlet and drain plugs (if removed).

⚠ WARNING: EXPLOSION HAZARD
Do NOT energize a Hazardous Locations motor without all grease fittings properly installed.

4.2.5 EXAMPLE: LUBRICATION

Assume - NEMA 286T (IEC 180), 1750 RPM Vertical motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 4-1 list 10,000 hours for standard conditions.
2. Table 4-2 classifies severity of service as "Severe" with a multiplier of 0.5.
3. Table 4-3 lists a multiplier value of 0.5 for "Vertical"
4. (Eq. 4.2) Interval = 10,000 hrs x 0.5 x 0.5 = 2500 hrs

Table 4-4 shows that 1.5 in^3 of grease is to be added.

Relubricate every 2,500 hrs of service with 1.5 in^3 of recommended grease.

4.3 TROUBLE-SHOOTING

⚠ WARNING: READ INSTRUCTIONS:
Before trouble-shooting a motor, carefully read and fully understand the warnings, cautions, & safety notice statements in this manual.

⚠ WARNING: Hazardous Locations Motor Repair:
Motors nameplated for use in Division 1 Hazardous Locations can only be disassembled, modified or repaired by the plant of manufacturer or a facility that is Listed under UL's category "Motors and Generators, Rebuilt for use in Hazardous Locations". Failure to follow these instructions could result in serious personal injury, death and/or property damage

CAUTION: DISASSEMBLY APPROVAL REQUIRED:
Motor disassembly must be performed by a party approved by the motor manufacturer. To disassemble the motor without approval voids the warranty.

4.3.1 GENERAL TROUBLE-SHOOTING WARNINGS

1. **DISCONNECT POWER TO THE MOTOR BEFORE PERFORMING SERVICE OR MAINTENANCE.**
2. **Discharge all capacitors before servicing motor.**
3. **Always keep hands and clothing away from moving parts.**
4. **Be sure required safety guards are in place before starting equipment.**
5. **If the problem persists contact the manufacturer.**

4.3.2 Motor Trouble-shooting Cause / Corrective Action - Table 4-5

Issue:	Likely Cause:	Corrective Action:
Motor fails to start upon initial installation:		
A.)	Supply voltage is too low or is severely unbalanced (one phase is low or missing).	(1) Check power supply fuses (2) Match motor lead wiring to nameplate connection diagram and supply voltage (3) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3). Correct as needed (4) Obtain correct motor to match actual supply voltage.
B.)	Motor leads are miswired at conduit box.	
C.)	Driven load exceeds motor capacity	(1) Verify that motor & load turn freely (2) Disconnect motor from load & ensure motor turns freely. Note: Roller bearings make noise when motor is uncoupled and shaft is rotated (3) Verify that motor starts when disconnected from load (4) Remove excessive / binding load if present.
D.)	Load is jammed.	
E.)	Fan guard is bent and making contact with fan	Replace fan guard & fan (if blades are damaged)
F.)	VFD with power factor capacitors installed	Remove power factor correction capacitors if equipped
G.)	VFD with motor neutral lead grounded	Ensure that motor neutral lead is ungrounded
H.)	VFD programmed incorrectly	(1) Repeat checks listed above (2) Verify that VFD current limit and starting boost are set correctly (5) Double-check motor and feedback parameter settings and VFD permissives (6) Repeat autotune (for vector drives) procedure (7) Consult VFD supplier.
Motor has been running, then slow down, stalls, or fails to restart:		
A.)	Supply voltage has drooped or has become severely unbalanced	(1) Replace fuse or reset circuit breaker. Allow motor to cool down before resetting manual protector on motor. **Warnings** - See section 1.1 for automatic and manual reset protector warnings (2) Verify that rated and balanced supply voltage has been restored before restarting motor. Measure voltage during restart. Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3).
B.)	Motor is overloaded	(1) Verify that motor & load turn freely. Repair binding components as needed (2) Reduce driven load to match motor capacity or increase motor size to match load requirements.
C.)	Motor bearings are seized	
D.)	Load is jammed.	
E.)	VFD will not restart motor after tripping	(1) Check fault codes on VFD and follow VFD troubleshooting procedures (2) Verify that VFD input voltage is balanced and within limits (3) Remove excessive mechanical load if present.
F.)	Capacitor failure on single phase motor (if equipped)	**Warning: Potential Shock Hazard**: Contact service shop to check capacitor.
Motor takes too long to accelerate:		
A.)	Motor leads are not connected correctly	Match motor lead wiring to nameplate diagram.
B.)	Supply voltage has drooped or become severely unbalanced.	(1) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3). Correct as needed (2) Obtain correct motor to match actual supply voltage.
C.)	Load exceeds motor capability	Determine correct motor size and contact motor representative to obtain replacement motor.
D.)	Faulty start capacitor (Single Phase)	Motor may be too small for load. Record acceleration time. Start capacitors may fail if acceleration time exceeds 3 seconds.
E.)	Mechanical Failure	(1) Check to make sure motor & load turn freely (2) Disconnect motor from load & ensure motor turns freely
Motor rotates in the wrong direction:		
A.)	Incorrect wiring connection at motor	[Single Phase] Reconnect motor according to wiring schematic provided. Note: Some motors are non-reversible
		[Three Phase] Interchange any two power supply (phase) leads.
Motor overheats or overload protector repeatedly trips		
A.)	Driven Load is excessive	(1) If motor current exceeds nameplate value, ensure that driven load has not increased. Correct as needed. (2) If new motor is a replacement, verify that the rating is the same as the old motor. If previous motor was a special design, a general purpose motor may not have the correct performance.
B.)	Ambient temperature too high	Most motors are designed to operate in an ambient up to 40 °C. (See section 4.2.2 Hot Surface Caution)
C.)	Motor cooling fins and/or vent openings blocked	Remove foreign materials – clear vent openings, fan guard air inlets and frame fins (TEFC motors)
D.)	Insufficient Air Flow	TEAO (Totally Enclosed Air Over) motors: Measure airflow next to motor surface and obtain minimum requirements from motor manufacturer.

	E.)	Motor is started too frequently	See section 3.4.5.3
	F.)	Supply voltage too low, too high, or unbalanced	(1) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3) Correct as needed (2) Reconnect motor per input voltage (3) Obtain correct motor to match power supply.
Motor Vibrates			
	A.)	Motor misaligned to load.	Realign load
	B.)	Load out of balance (Direct drive application)	(1) Ensure that load is dynamically balanced: (2) Remove motor from load and inspect motor by itself. Verify that motor shaft is not bent. Rule of thumb is 0.002" runout for shafts extension lengths up to 3.00". Add 0.0005" per every additional inch of shaft length beyond 3.00".
	C.)	Uneven tension on multiple belts	Mixing new with used belts. Replace multiple belt applications with a complete set of matched belts.
	D.)	Driven load operating at resonant point / natural frequency.	(1) De-energize motor and record vibration as load coasts from 100% speed to 0 RPM. If vibration drops immediately, vibration source is electrical. If levels do not drop immediately, source is mechanical (2) Redesign system to operate below the resonant point (3) On VFD-driven loads, program skip frequencies to bypass resonant points (4) Increase carrier frequency to obtain <3% THD current (5) On variable torque loads reduce volts/hertz below base speed.
	E.)	VFD torque pulsations	(1) Adjust VFD to obtain <3% THD current @ rated motor current (2) Adjust VFD stability for smooth operation. Vector drives may be unstable at light load.
	F.)	Motor miswired at terminal box	Match motor lead wiring to nameplate connection diagram.
	G.)	Uneven, weak or loose mounting support.	Shim, strengthen or tighten where required.
	H.)	Motor bearings defective	Test motor by itself. If bearings are bad, you will hear noise or feel roughness. Roller bearings are normally noisy when operated without load. If sleeve bearing, add oil per nameplate instructions. For motors with regreasing provisions, add grease per relubricating instructions (see section 4.2.3). If noise persists contact warranty service.
	I.)	Motor out of balance	Disconnect from load. Set motor on rubber pads on solid floor. Secure a ½ height key in shaft keyway and energize from balanced power supply @ rated voltage. Record vibration levels and compare with appropriate standards. If excessive vibration persists contact motor manufacturer.

Bearings repeatedly fail.			
	A.)	Load to motor may be excessive or unbalanced	(1) If belt drive check system per section 3.3.4. (2) Other than belting, check loading on motor shaft. An unbalanced load will also cause the bearings to fail. (3) Check runouts of mating components, such as a C-face and pump flange.
	B.)	Bearings contaminated.	Motor enclosure not suitable for environment. Replace with correct enclosure construction
	C.)	Incorrect grease or bearings for ambient extremes.	See section 4.2.1
	D.)	VFD bearing damage	Ground brush, common mode filter, or insulated bearings must be added. Contact motor manufacturer.
Motor, at start up, makes a loud rubbing, grinding, or squealing noise.			
	A.)	Contact between rotating and stationary components	Belt squeal during across the line starting is normal: (1) Verify that supply voltage is within limits (see section 3.4.1.3). (2) Ensure that motor lead wiring matches nameplate connection diagram: (3) Isolate motor from load. (4) To locate point of contact turn motor shaft by hand. (5) If point of contact is not located contact motor service shop.
Start capacitors repeatedly fail.			
	A.)	The motor acceleration time is too long	Motor may be too small for load. Record acceleration time. Start capacitors may fail if acceleration time exceeds 3 seconds.
	B.)	Motor is being started too frequently	Excessive starting will damage motor capacitors. Contact motor manufacturer if motor is started more than 20 times/hour or if acceleration time exceeds 3 seconds.
	C.)	Motor voltage low	Verify that voltage at the motor terminals is within limits (see section 3.4.1.3).
	D.)	Defective start switch inside motor	Motor internal switch failure overheats start capacitor. Contact service shop or motor manufacturer.
Run capacitor fails.			
	A.)	High ambient temperature	Verify that the ambient does not exceed motor's nameplate value

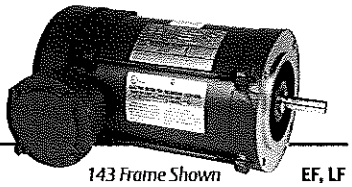
	B.)	Input voltage exceeds limit	Verify that voltage to the motor terminals is within limits (see section 3.4.1.3).
	C.)	Power surge to motor (caused by lightning strike or other high transient voltage).	If a common problem, install surge protector.

GRIT WASHER

NIDEC MOTOR CORPORATION

www.nidec-motor.com

General Purpose Three Phase, Totally Enclosed Fan Cooled (TEFC) Div. 1 Hazardous Location, Standard & Energy Efficient, Dual & Single Label, C-Face



143 Frame Shown

EF, LF
PH63

APPLICATIONS:

For pumps, fans, compressors, conveyors and tools located in hazardous locations as defined by Class and Group.

FEATURES:

For all Products in this Section:

- UL® Listed & CSA® Certified
- Cast Iron Inner Bearing Caps (180 Frame & Larger
- 40°C Ambient, NEMA® Design B Performance (04)
- Regreasable Bearings, 180 Frame & Up
- Lifting Provisions, 180 Frame & Up
- Conversion Kits: Cast Iron Fan Cover (180 Frame & Up)
- Sealed Bearings 56-140, Shielded 180 Frame & Up
- Class, Group & Temp Code as Noted Below

For Catalog Numbers Beginning with "X" or "Y":

- Cast Iron Frame Except Where Noted
- Cast Iron End Brackets & Conduit Box
- Class F Insulation
- 1.00 Service Factor on 60 Hertz
- Stainless Steel Nameplate & Zinc Plated Hardware
- Shaft Slinger on Pulley End for IP54 Protection

For Catalog Numbers Beginning with "XS":

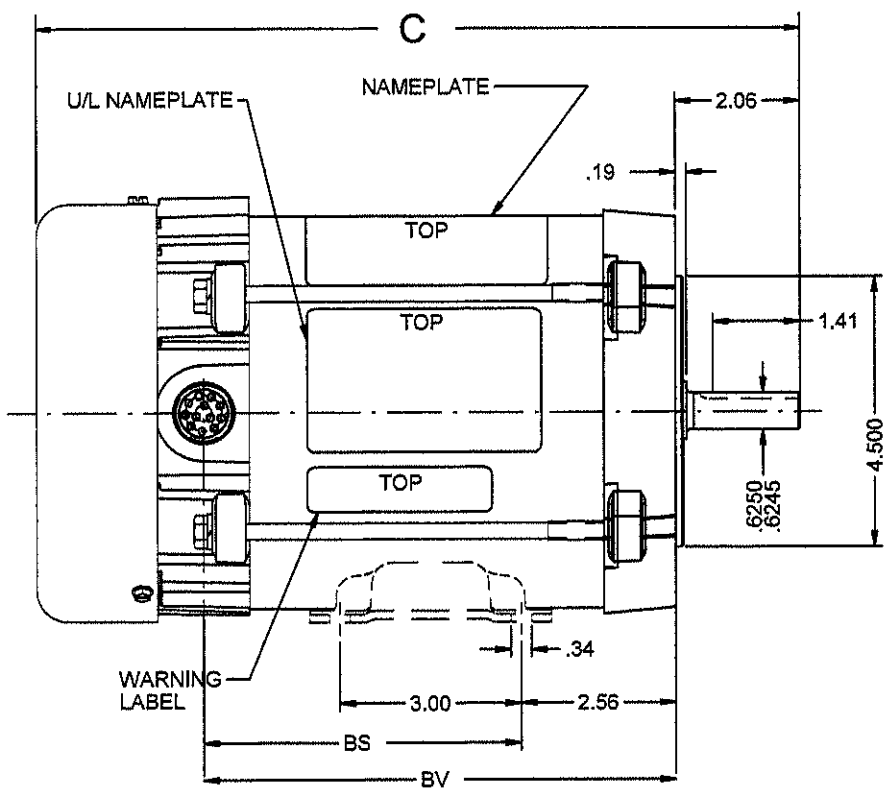
- Aluminum End Brackets & Conduit Box
- Class B Insulation

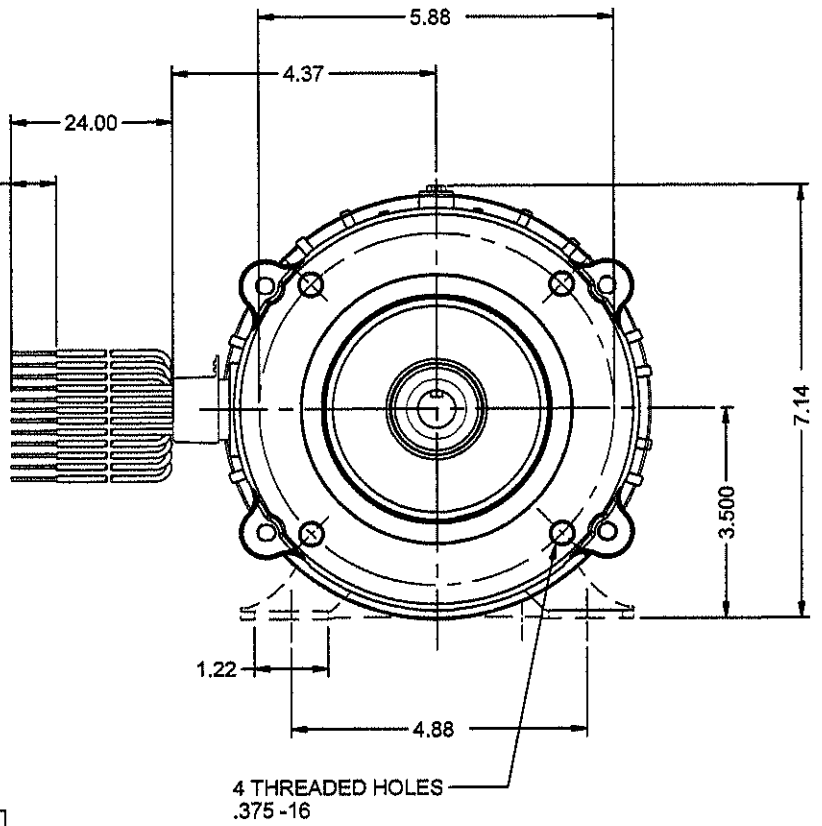
Footless

HP	RPM	Voltage	Frame	Catalog Number	Class I Group	Class II Group	Temp Code	List	Discount Symbol	"C" Dim. (inches)	Ship Wt. (lbs.)	Full Load Eff.	Full Load Amps	Notes
1/3	1800	208-230/460	56C	XS13SA2DCR	CD	EFG	T3C	$661	DS-3F	13.3	29	-	1.4-1.3/0.65	13, 24
	1800	230/460	56C	Y13S2BCR	D	-	T2B	$638	DS-3F	11.6	46	-	1.5/0.7	
1/2	1800	208-230/460	56C	XS12SA2DCR	CD	EFG	T3C	$656	DS-3F	13.3	30	-	2.0-1.9/1.0	24
	1800	230/460	56C	Y12S2BCR	D	-	T2B	$672	DS-3F	11.6	48	-	1.7/0.9	
3/4	3600	208-230/460	56C	XS34S1ACR	CD	EFG	T3C	$692	DS-3F	13.3	34	-	2.7-2.6/1.3	24
	1800	230/460	56C	XS34SA2ACR	CD	EFG	T3B	$731	DS-3F	13.5	36	-	2.6/1.3	51
	1800	230/460	56C	Y34S2BCR	D	-	T2B	$708	DS-3F	11.6	52	-	2.7/1.3	
1	3600	208-230/460	56C	XS1S1ACR	CD	EFG	T3C	$700	DS-3F	13.8	36	-	3.2-3.0/1.5	24
	3600	230/460	56C	Y1S1BCR	D	-	T2B	$716	DS-3F	11.6	47	-	3/1.5	
	1800	208-230/460	143TC	XS1P2ACR	CD	EFG	T3B	$1,279	DS-3CX	15.3	43	85.5	3.3-3.3/1.6	51
1-1/2	1800	208-230/460	143TC	XS32S2ACR	CD	EFG	T3C	$1,175	DS-3CX	14.8	44	84.0	5.0-4.9/2.5	51
	1800	230/460	145TC	X32E2BCR	D	FG	T3B	$1,202	DS-3CX	13.2	75	84.0	2.1	
	1800	208-230/460	145TC	XS32P2ACR	D	FG	T3B	$1,351	DS-3CX	15.8	50	86.5	4.9-4.8/2.4	51
	1800	208-230/460	145TC	XS2E2ACR	CD	EFG	T3C	$1,430	DS-3CX	16.8	59	84.0	6.7-6.4/3.2	51
2	1800	208-230/460	145TC	XS2P2ACR	CD	EFG	T3C	$1,427	DS-3CX	15.8	50	86.5	6.2-6.0/3.0	51
	1800	230/460	145TC	X2E2BCR	D	FG	T3B	$1,344	DS-3CX	13.2	75	84.0	5.6/2.8	
	1800	230/460	182TC	X3E2BCR	D	FG	T3B	$1,472	DS-3CX	16.1	105	87.3	8.2/4.1	
3	1800	230/460	184TC	X5E2BCR	D	FG	T3B	$1,605	DS-3CX	16.1	118	87.5	12.8/6.4	
5	1800	230/460	213TC	X7E2BCR	D	FG	T3B	$2,198	DS-3CX	19.9	145	89.5	18.6/9.3	
7-1/2	1800	230/460	215TC	X10E2BCR	D	FG	T3B	$2,360	DS-3CX	19.9	170	89.5	25.6/12.8	
10	1800	230/460	254TC	X15E2BCR	CD	FG	T3C	$3,046	DS-3CX	25.4	300	91.0	37.0/18.5	

Note 04 On 60 Hertz Sine Wave power
Note 13 Steel Frame Construction
Note 24 Automatic Reset Thermal Overload Protector
Note 51 Equipped with Winding Thermostat

† All marks shown within this document are properties of their respective owners.





VAR	MODEL	CATALOG NO.	C	BS	BV	HP	VOLTS	HZ	RPM	BASE REQUIREMENT	PROTECTOR
001	PH63GVABA-1020	XS34S1ACR	13.27	—	8.44	3/4	208-230/460	60	3450	NONE	AUTO
002	PH63GVAAT-1016	XS1S1ACR	13.77	—	8.94	1	208-230/460	60	3450	NONE	AUTO
003	PH63GVACM-1051	XS12SA2BCR	13.27	—	8.44	1/2	230/460	60/50	1725/1425	NONE	AUTO
004	PH63GVADL-1070	XS1SA2ACR	14.27	—	9.44	1	208-230/460	60	1725	NONE	AUTO
005	PH63GVADH-1067	XS1SA2AC	14.27	6.88	9.44	1	208-230/460	60	1725	YES	AUTO
006	PH63GVACL-1050	XS34SA2ACR	14.27	—	9.44	3/4	208-230/460	60	1725	NONE	AUTO

NOTES:

1.) CONDUIT BOX SUPPLIED DETACHED.

ROTATION : REVERSIBLE

SHEET NUMBER	REV
1 OF 2	C

REVISION RECORD FOR: JC# 63929

VAR " 008 & 009" ADDED.

REVISION DATE: 4-26-07

EMERSON. Motor Technologies

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ISSUED BY	REVIEWED BY	ENGINEER APPROVED
K. MUJUMDAR	R. MORE	R. MORE

TITLE	CODE	ITEM NO.	SIZE
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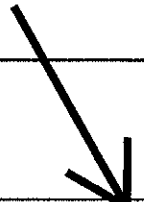

VAR	MODEL	CATALOG NO.	C	BS	BV	HP	VOLTS	HZ	RPM	BASE REQUIREMENT	PROTECTOR
007	PH63GVAEB-1081	XS13SA2DCR	13.27	5.88	8.44	1/3	208-230/460	60/50	1725/1425	NONE	AUTO
008	PH63GVADS-1075	XS34SA2AC	14.27	6.88	9.44	3/4	208-230/460	60 & 50	1725 & 1425	N56	AUTO
009	PH63GVADW-1077	XS12SA2AC	13.27	5.88	8.44	1/2	208-230/460	60/50	1725/1425	N56	AUTO

REV: C

SHEET NUMBER	REV
2 OF 2	C

REVISION DATE: 4-26-07

REVISION RECORD FOR: JC# 63929

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ISSUED BY	REVIEWED BY	ENGINEER APPROVED
K. MUJUMDAR	R. MORE	R. MORE

TITLE	CODE	ITEM NO.	SIZE
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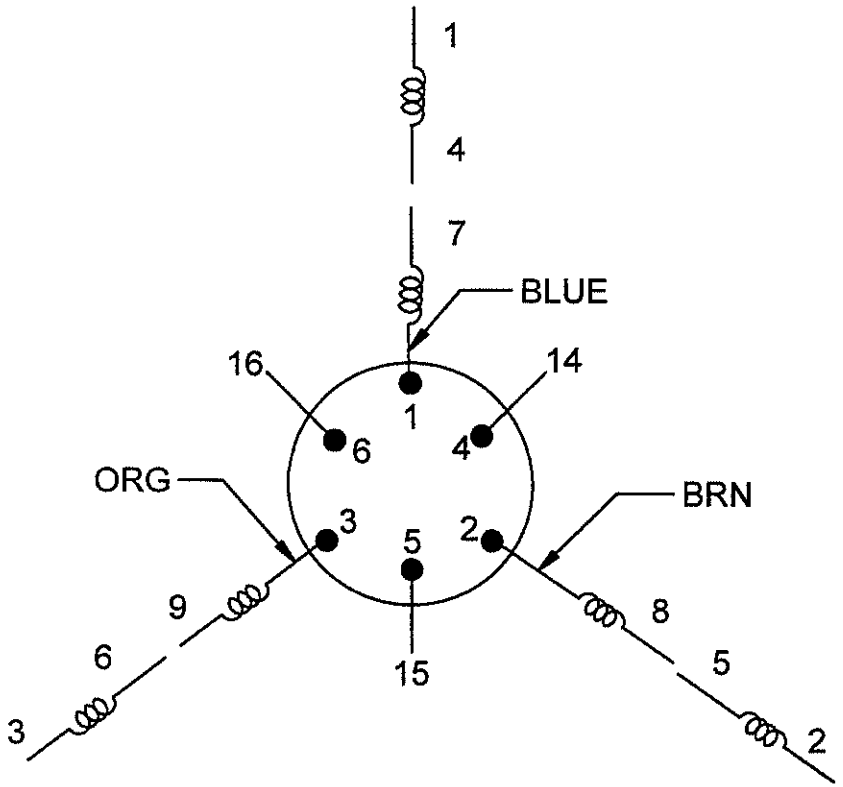


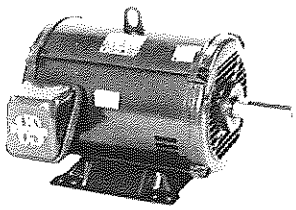
LOW VOLTAGE		HIGH VOLTAGE
1 & 7	LINE 1	1 — LINE 1
2 & 8	LINE 2	2 — LINE 2
3 & 9	LINE 3	3 — LINE 3
4 & 14	INS	4 & 7 — INS
5 & 15	INS	5 & 8 — INS
6 & 16	INS	6 & 9 — INS

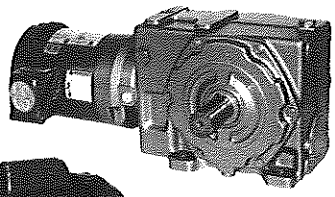
14, 15, 16 INDIVIDUALLY INSULATED

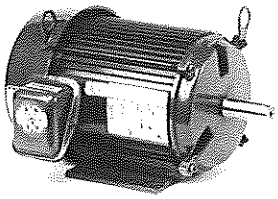
Installation, Operation & Maintenance Instructions

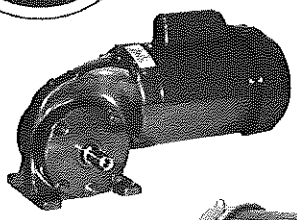
ENGLISH

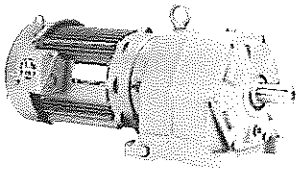
For your safety, read and retain this manual



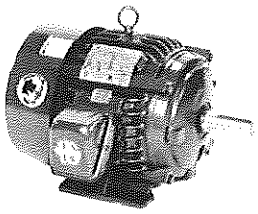




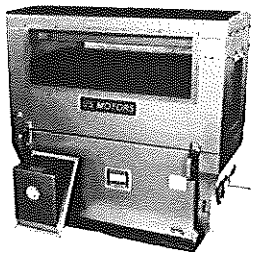


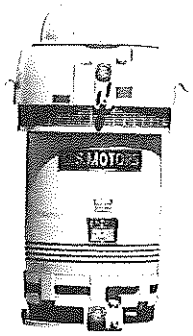


GEARMOTORS

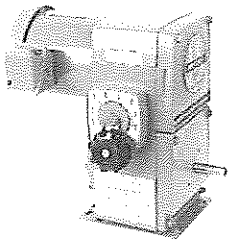


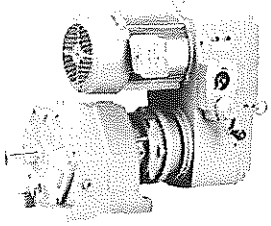
HORIZONTAL MOTORS



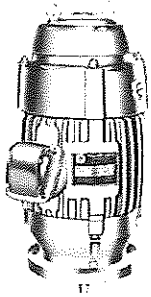


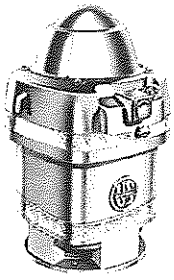
TITAN MOTORS





VARIABLE SPEED DRIVES





VERTICAL MOTORS

EMERSON
Motor Technologies

Send for free brochure by product name

Emerson Motor Company
8050 West Florissant Ave.
PO Box 36912
St. Louis, MO 63136

448888 *Rev. 01/04*

ENGLISH

SAFETY FIRST

⚠ DANGER *High voltage and rotating parts can cause serious or fatal injury. Safe installation, operation and maintenance must be performed by qualified personnel. Familiarization with, and adherence to, NEMA MG2, the National Electrical Code (NEC), and local codes is required. It is important to observe safety precautions to protect personnel from possible injury.*

PERSONNEL SHOULD BE INSTRUCTED TO:

1. Be familiar with the equipment and read all instructions thoroughly before installing or working on equipment.
2. Avoid contact with energized circuits or rotating parts.
3. Disconnect all power sources before initiating any maintenance or repair.
4. Act with care in accordance with prescribed procedures in handling and lifting this equipment.
5. Be sure unit is electrically grounded in accordance with code requirements.
6. Be sure equipment is properly enclosed or protected to prevent access by children or other unauthorized personnel to prevent possible accidents.
7. Be sure shaft key is fully captive before unit is energized.
8. Avoid contact with capacitors until safe discharge procedures have been completed.
9. Provide proper guarding for personnel against rotating parts and applications involving high inertia loads which can cause overspeed.
10. Avoid extended exposure to equipment with high noise levels.

INSPECTION AND HANDLING

Inspect unit to make sure no damage has occurred during shipment. Check nameplate for correct speed, horsepower, voltage, hertz and phase for conformance with power supply and equipment.

⚠ WARNING *Units should be lifted using all eyebolts or lugs if provided. These eyebolts or lugs are provided for lifting this unit only and must not be used to lift any additional weight. Lifting angle, from shank of eyebolt, must not exceed 30 degrees for machines with single and 45 degrees for machines with multiple lifting means. Replacement eyebolts must be per ASTM A489 or equivalent. All eyebolts must be securely tightened. Be careful not to touch overhead power lines with lifting equipment. Failure to observe this warning may result in serious personal injury.*

STORAGE

Units should be stored indoors, in a clean, dry location & winding should be protected from excessive moisture absorption. NOTE: If motors are to be stored for over one year, refer to Emerson Motor Company. If motors are to be stored for over one year and if gear and belt transmission units are to be stored for over six months, refer to Emerson Motor Company.

LOCATION

⚠ WARNING *Use only UL Listed Hazardous Location Motors for service in Hazardous Locations as defined in Article 500 of the NEC. Units should be located in a clean, well-ventilated area. Units should be located in a suitable enclosure or protected to prevent access by children or other unauthorized personnel to prevent possible accidents.*

INSTALLATION / MOUNTING

Mount unit on a firm, flat surface sufficiently rigid to prevent vibration. Drive belts and chains should be tensioned in accordance with supplier recommendations. Couplings should be properly aligned and balanced. For belt, chain and gear drive selection refer to the drive or equipment manufacturer. For application of drive equipment refer to applicable information in NEMA MG1.

Motors have been dynamically balanced using a half key the same length as the full key shipped with the motor. If pulley length keyway is less than this length, rework long key by removing one-half of excess length between pulley and end of key to maintain balance.

Do not restrict motor ventilation. Unless otherwise specified on nameplate, motor is designed for operation in accordance with NEMA MG1 "Usual Service Conditions" which states an ambient temperature range of -15° C to 40° C (5° F to 104° F). Standard grease lubricated units are suitable for operation within this temperature range. Special lubricants may be required for ambient temperatures outside of this range. Note: Motors operating under rated load and allowable ambient conditions may feel hot when touched; this is normal and should not be cause for concern. When in doubt, measure frame surface temperature and confer with nearest office. Enclosed motors normally have condensation drain openings. Insure that drain openings are properly located and open (plugs removed) for the motor mounting position. Drain openings should be at lowest point of end brackets, frame housing and terminal housing when the motor is installed. This may require modification of motor to accomplish. If unit appears wet, and/or has been stored in a damp location, dry out thoroughly and check for adequate insulation resistance to ground before operating.

⚠WARNING ***Guards should be provided for all exposed rotating parts to prevent possible personal injury. Keep fingers and foreign objects away from ventilation and other openings. Applications involving high inertia loads may damage this equipment due to motor overspeed during coast shutdown. Such applications should be referred to Emerson Motor Company.***

⚠ CAUTION ***Do not force drive coupling or other equipment onto shaft, as bearing damage may result.***

POWER SUPPLY AND CONNECTIONS

The power supply must agree with values on nameplate. Terminal voltage should not vary more than ±10% of nameplate voltage at rated frequency. Unbalanced line voltage, greater than one percent, can cause overheating. Do not exceed the rated load amperes on the nameplate. Starting controls and overload protection should be properly sized in accordance with the NEC and the control manufacturer's recommendations.

Motor connections should be made by following instructions on connection diagram. Determine direction of rotation before connecting driven equipment. If direction of rotation label is supplied, operate only in specified direction. Rotation may be reversed on three phase motors by interchanging any two line connections. On single phase motors interchange leads per connection diagram on motor. Wiring of units, controls and grounding shall be in accordance with local and NEC requirements.

⚠WARNING ***Failure to properly ground unit may cause serious injury to personnel. Where unexpected starting could be hazardous to personnel, do not use automatic reset starting devices.***

USE OF VARIABLE FREQUENCY DRIVES

Electric motors can be detrimentally affected when applied with variable frequency drives (VFD's). The non-sinusoidal waveforms of VFD's have harmonic content which causes additional motor heating; and high voltage peaks.

ENGLISH

Other effects of VFD's on motor performance include reduced efficiency, increased load current, vibration and noise. Standard motors utilized with VFD's must be limited to those application considerations defined in NEMA MG-1 Part 30. Refer to PDS #811-215 available at www.usmotors.com.

NEMA MG-1 Part 31 defines performance and application considerations for Definite-Purpose Inverter Fed Motors. To insure satisfactory performance and reliability, U.S. Electrical Motors offers and recommends nameplated inverter duty motor products which meet the requirements of NEMA MG-1 Part 31. The use of non-inverter duty motors may result in unsatisfactory performance or premature failure, which may not be warrantable under the Terms and Conditions of Sale. Contact your Emerson Motor Company Field Sales Engineer for technical assistance for motor selection, application and warranty details.

OIL LUBRICATION

Most oil lubricated units are shipped without oil. Refer to Instruction Manual with unit for specific type and grade of oil to be used, change interval and level. If lubrication instructions specify synthetic oil, do not substitute.

⚠WARNING ***For applications in the food and drug industry (including animal food), consult the petroleum supplier for lubricants that are acceptable to the Food and Drug Administration and other governing bodies.***

MAINTENANCE

Inspect units at regular intervals. Keep units clean and ventilation openings clear of dust, dirt or other debris. Lubricate units per this operating instruction folder and instruction plate on unit. Excessive lubrication may damage the unit. Do not over grease.

⚠WARNING ***Disconnect all power sources to the unit and discharge all parts which may retain an electrical charge before attempting any maintenance or repair. Screen and covers must be maintained in place when unit is in operation. Failure to observe this warning may result in personal injury.***

U.L. Listed Motors for use in Hazardous Locations: Repair of these motors must be made by the manufacturer or manufacturer's authorized service station approved to repair U.L. Listed Motors. The U.L. listing applies to the electric motor only and not the belt or gear transmissions or other devices that may be connected to the motor.

COOLING TOWER DUTY MOTORS

During installation, insure drain plugs are removed from lower drain holes in bracket and outlet box. All upper drain holes must be plugged at all times. External umbrella seal must be in place for shaft up applications. Motors with Bearing numbers "XXXX-2RS" are double sealed and not to be relubricated.

VARIDRIVE UNITS

Do not turn speed control hand wheel while unit is not operating; this may cause damage to the unit. Hand wheel position is a relative speed indication only. Use direct speed sensing accessory for precise speed indication. Units equipped with electric remote speed indicator accessory are not calibrated at the factory and must be calibrated at site. Refer to calibration instructions with the unit.

VARIDRIVES equipped with ENDOLUBE construction do not require lubrication of the sliding Varidisc. Operate VARIDRIVE through its entire speed range weekly.

⚠WARNING *Do not force control wheel beyond speed limits shown on the nameplate. The mechanism and belt are designed for the rated speed and horsepower shown on the nameplate. Operation beyond these limits may result in damage to the belt and mechanism and possible injury to personnel. The covers on the frame case must not be removed or left off while unit is in operation. Do not attempt to disassemble or repair the driven pulley discs because high spring tension may be released causing injury to personnel. Refer to authorized Service Center. Refer to VARIDRIVE Installation and Maintenance Manual for complete belt changing instructions. For additional detailed information, request specific product installation and maintenance manual.*

GREASE LUBRICATION INSTRUCTIONS

Units are prelubricated at the factory and do not require initial lubrication. Relubricating interval depends upon speed, type of bearing and service. Refer to Table 1 for suggested regreasing intervals. Operating conditions may dictate more frequent lubrication. Motor must be at rest and electrical controls should be locked open to prevent energizing while motor is being serviced (refer to section on Safety). If motor is being taken out of storage, refer to storage procedures.

To relubricate bearings, remove the drain plug. Inspect grease drain and remove any blockage with a mechanical probe taking care not to damage bearing.

⚠ CAUTION *Under no circumstances should a mechanical probe be used while the motor is in operation. Add new grease at the grease inlet, refer to Table 1 for replenishment quantities. New grease must be compatible with grease in the motor (See Caution Note). Run the motor for 15 to 30 minutes with the drain plug removed to allow purging of any excess grease. Shut off unit and replace the drain plug. Return motor to service. Some motors have sealed bearings and are not regreasable.*

Over greasing can cause excessive bearing temperatures, premature lubricant breakdown and bearing failure. Care should be exercised against over greasing.

Table 1

Recommended Grease Replenishment Quantities & Intervals (For lubrication of units in service)

Bearing Number-Common		Bearing Number-AFBMA		Grease FL Oz.	Lubrication Interval		
62XX	63XX	XXBC02	XXBC03		3600 RPM	1800 RPM	1200 RPM
6203-6207	6303-6306	17-35	17-30	0.2	2 Years	3 Years	3 Years
6208-6212	6307-6309	40-60	35-45	0.4	1 Year	2 Years	2 Years
6213-6215	6310-6311	65-75	50-55	0.6	1 Year	2 Years	2 Years
6218-6220	6312-6315	80-100	60-75	1.0	6 Mos.	1 Year	2 Years
6221-6228	6316-6320	105-140	80-100	1.8	6 Mos.	1 Year	1 Year

For motors mounted vertically or in hostile environments, reduce intervals shown by 50 percent.

Refer to motor nameplate for bearings provided on a specific motor.

For bearings not listed in table above, the amount of grease required may be calculated by the formula:

$$G=0.11 \times D \times B$$

Where;

G = Quantity of grease in fluid ounces.

D = Outside diameter of bearing in inches.

B = Width of bearing in inches.

ENGLISH

Table 2
RECOMMENDED GREASES

THE FOLLOWING GREASES ARE INTERCHANGEABLE WITH THE GREASE AS PROVIDED IN UNITS SUPPLIED FROM FACTORY (UNLESS STATED OTHERWISE ON A LUBRICATION NAMEPLATE PROVIDED ON MOTOR).

MANUFACTURER	GREASE (NLGI No. 2)
EXXON CORP.	POLYREX - EM
CHEVRON U.S.A. INC.	SRI NO. 2

⚠ CAUTION *Greases of different bases (lithium, polyurea, clay, etc.) may not be compatible when mixed. Mixing such greases can result in reduced lubricant life and premature bearing failure. When necessary, prevent such intermixing by disassembling the motor, removing all old grease from bearings and housings (including all grease fill and drain holes). Inspect and replace damaged bearings. Fill bearing housings and bearing approximately 30% full of new grease. Remove any excess grease extending beyond the edges of the bearing races and retainers. Refer to Table 2 for recommended greases.*

WARRANTY

LIMITED WARRANTY

All U.S.E.M. products are warranted against defects in workmanship and materials for 12 months from date of installation, not to exceed 18 months from date of shipment from EMC. Some of U.S.E.M's products carry a warranty period longer than 12 months. Please refer to the current price catalog or to EMC for details on specific products. This limited warranty does not apply to any product which has been subject to misuse, misapplication, neglect (including without limitation, inadequate maintenance), accident, improper installation, modification, adjustment, or repair. This constitutes EMC's only warranty in connection with this sale and is in lieu of all other warranties, expressed or implied, written or oral. THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE THAT APPLY TO THIS SALE. No employee, agent, dealer or other person is authorized to give any warranties on behalf of EMC nor to assume for EMC any other liability in connection with any of its products.

EXCLUSIVE REMEDY

EMC's liability shall be limited exclusively to repairing or replacing any product found by EMC to be defective, or at EMC's option, to refund the purchase price of its product. Such product shall be returned, freight prepaid, to the nearest U.S.E.M. authorized service station or EMC factory. It is agreed that such replacement, repair, or refund be the sole and exclusive remedies available from EMC. EMC shall not be liable for damages of any sort whatsoever beyond these exclusive remedies including incidental and consequential damages regardless of whether any claim is based upon contract, negligence, strict liability, tort, warranty, or other basis. The repair or replacement of the product, or the refund of the purchase price, at EMC's option, constitutes fulfillment of all liabilities of EMC to the buyer for defective products.

RENEWAL PARTS AND WARRANTY SERVICE

When inquiring for renewal parts, call the nearest U.S. Electrical Motors Parts Stocking Distributor. For warranty service, call the nearest U.S. Electrical Motors Authorized Service Station. Give them complete Nameplate data, including identification number, etc.

Request installation and maintenance manuals by product name.

FOR SERVICE CALL:

NEAREST U.S.E.M. AUTHORIZED SERVICE STATION OR U.S.E.M. PRODUCT SERVICE ST. LOUIS, MO 1-800-566-1418

VISIT OUR WEB SITE

www.usmotors.com

ENGLISH

SALES REGION	PHONE	TOLL-FREE	FAX
EMERSON MOTOR COMPANY ST. LOUIS, MO		888 - 637 - 7333	314 - 553 - 2087
INTERNATIONAL SALES	314 - 553 - 4157	N/A	314 - 553 - 2135
MONTREAL, QUEBEC/CAN.	514 - 332 - 1880	800 - 361 - 5509	514 - 332 - 5912
MARKHAM, ONTARIO/CAN.	905 - 475 - 4670	N/A	905 - 475 - 4672
MONTERREY, MEXICO	011 - 52818 - 389 - 1300	N/A	011 - 52818 - 389 - 1310
CARACAS, VENEZUELA	582 - 237 - 7522	N/A	582 - 232 - 9727
BOGOTÁ, COLOMBIA	571 - 439 - 5420	N/A	571 - 439 - 5417

Notes

Notes

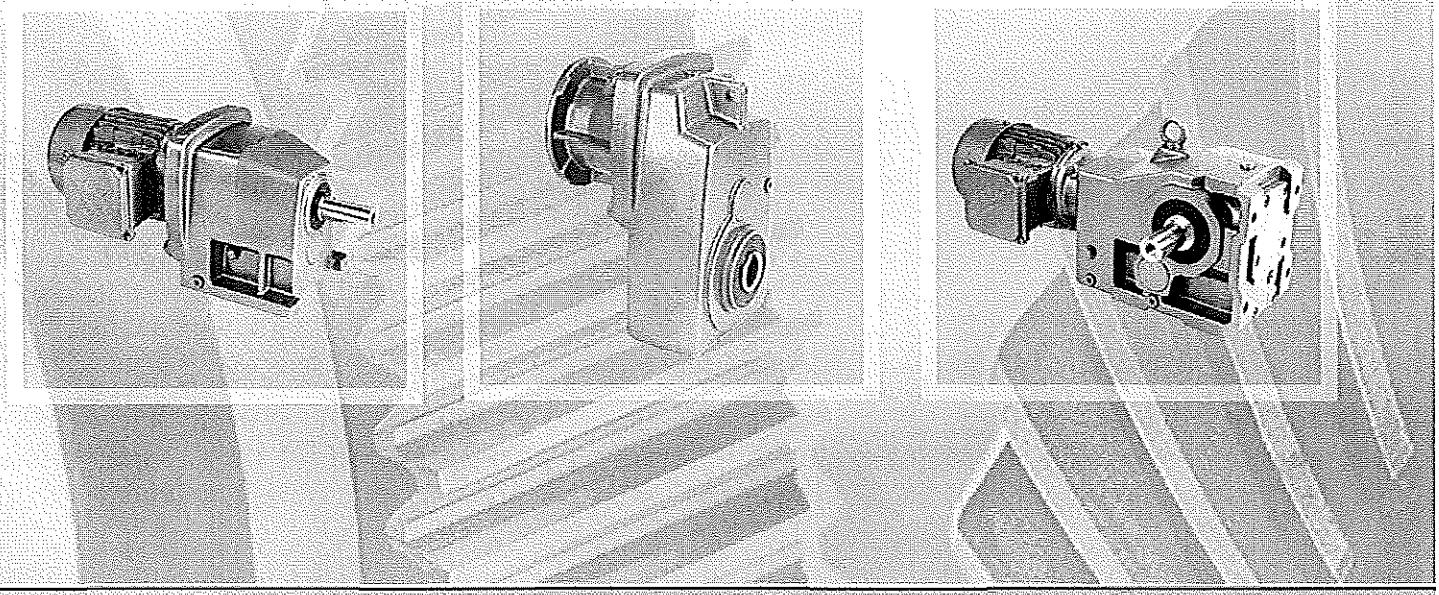
ENGLISH

SECTION III

MECHANICAL COMPONENTS

GRIT COLLECTOR

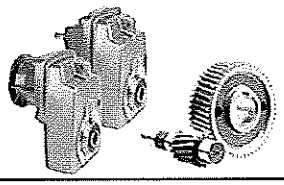
CONSTANT SPEED DRIVES



SIMPLE RELIABLE EFFICIENT

UNICASE™

NORD DRIVESYSTEMS

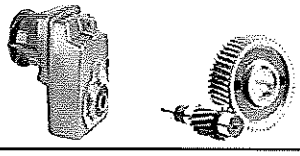


SK 4282
NEMA-C + W
Ratings & Combinations

Model Type	Gear Ratio	Output Speed	Output Torque*	Maximum input power◈ Solid input shafts type "W"				NEMA C-Face* Available Combinations							
				Input Speed											
	i_{tot}	n_2 1750 rpm	$T_{2\,max}$	1750 rpm	1150 rpm	875 rpm	580 rpm								
		[rpm]	[lb-in]	[hp]	[hp]	[hp]	[hp]	56C	140TC	180TC	210TC	250TC	280TC	320TC	360TC
SK 4282	4.70	372	9160	20.00	13.20	10.00	6.60			X	X	X			
	5.00	350	9160	20.00	13.20	10.00	6.60			X	X	X			
	5.43	322	9160	20.00	13.20	10.00	6.60			X	X	X			
	6.06	289	10620	20.00	13.20	10.00	6.60	X	X	X	X	X			
	7.13	245	10638	20.00	13.20	10.00	6.60	X	X	X	X	X			
	8.33	210	11257	20.00	13.20	10.00	6.60	X	X	X	X	X			
	9.23	190	14461	20.00	13.20	10.00	6.60	X	X	X	X	X			
	10.85	161	15045	20.00	13.20	10.00	6.60	X	X	X	X	X			
	12.68	138	15488	20.00	13.20	10.00	6.60	X	X	X	X	X			
	15.20	115	15930	20.00	13.20	10.00	6.60	X	X	X	X	X			
	18.18	96	15930	20.00	13.20	10.00	6.60	X	X	X	X	X			
	21.45	82	14921	19.41	12.81	9.71	6.41	X	X	X	X	X*			
	22.39	78	15036	18.61	12.28	9.30	6.14	X	X	X	X	X*			
	26.25	67	14231	15.13	9.98	7.56	4.99	X	X	X	X	X*			
	26.43	66	15815	16.56	10.93	8.28	5.47	X	X	X	X	X*			
	26.72	65	14160	14.60	9.64	7.30	4.82			X	X				
	32.04	55	15797	13.79	9.10	6.89	4.55			X	X				
	32.34	54	14337	12.28	8.11	6.14	4.05	X	X	X	X	X*			
	36.40	48	12169	9.27	6.12	4.63	3.06			X	X*				
	36.81	48	12390	9.44	6.23	4.72	3.11	X	X	X	X*				
	38.31	46	17700	12.92	8.53	6.46	4.26			X	X*				
	40.74	43	13771	9.40	6.20	4.70	3.10	X	X	X	X*				
	43.65	40	14160	8.99	5.93	4.49	2.97			X	X*				
	45.05	39	14107	8.73	5.76	4.36	2.88	X	X	X	X*				
	52.20	34	16089	8.68	5.73	4.34	2.86			X	X*				
	61.60	28	15877	7.05	4.66	3.53	2.33			X	X*				
	75.39	23	14063	5.13	3.39	2.57	1.69			X	X*				
	76.70	23	14063	5.13	3.39	2.57	1.69	X	X	X					
	90.52	19	14160	4.27	2.82	2.13	1.41	X	X	X*					
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	X	X	X*					
	155.40	11	11284	1.97	1.30	0.98	0.65	X	X*						

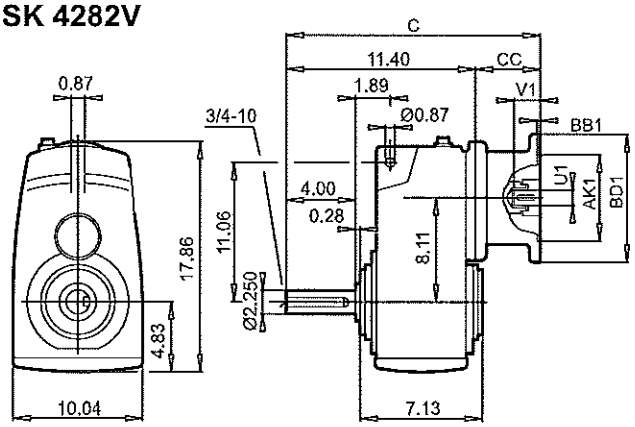
* Caution - The motor power may exceed the gear unit's mechanical torque capacity
◈ The mechanical power limit of the solid input shaft type "W" may limit the reducer rating.
All ratings are mechanical. See page 14 for thermal considerations.

	W	56C	140TC	180TC	210TC	250TC
SK 4282	165	154	170	170	201	223



SK 4282 + NEMA

SK 4282V



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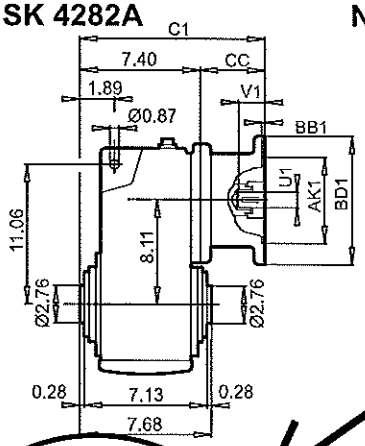
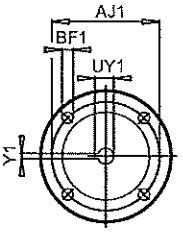
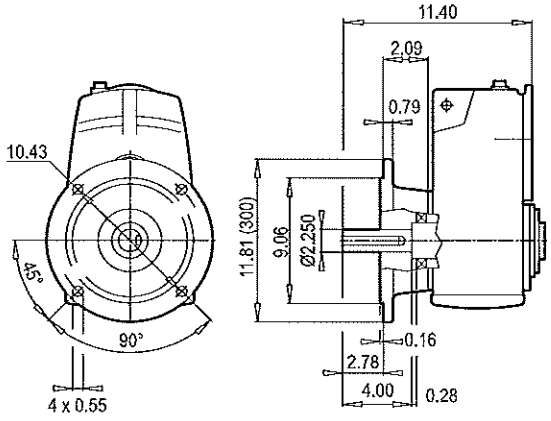


NEMA Input



Dimensions in Inches
DIMENSIONS

SK 4282VF



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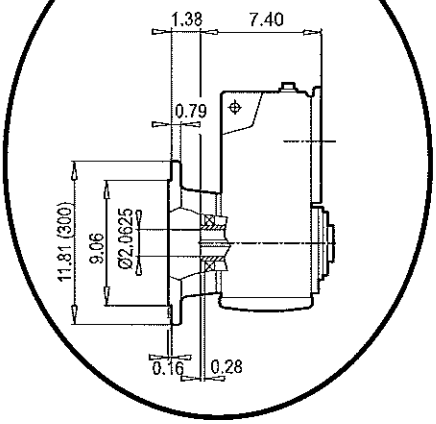
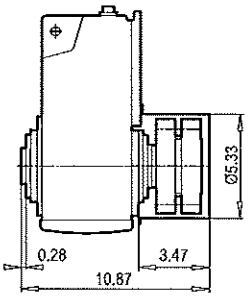
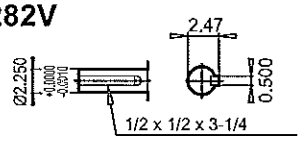


SK 4282ASH

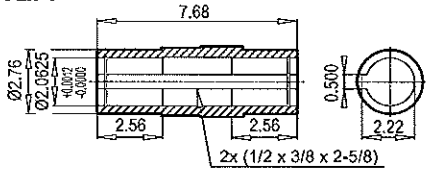


ALTERNATE SHAFTS SEE PAGES 388 - 393

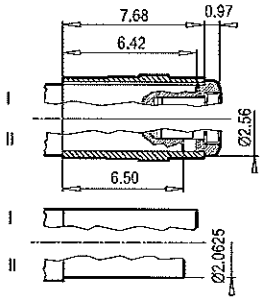
SK 4282V



SK 4282A



SK 4282AB ⇨ 394



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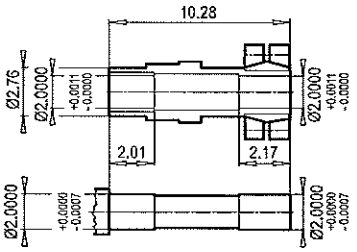


NEMA Dimensions

Type	AJ1	AK1	BB1	BD1	BF1	U1	V1	UY1	Y1	C	C1	CC
56C	5.88	4.500	0.18	6.54	0.43	0.625	2.06	0.71	0.188	15.74	11.74	4.30
140TC	5.88	4.500	0.18	6.54	0.43	0.875	2.12	0.96	0.188	15.74	11.74	4.30
180TC	7.25	8.500	0.23	9.17	0.59	1.125	2.62	1.24	0.250	19.34	15.34	7.90
210TC	7.25	8.500	0.39	9.17	0.59	1.375	3.12	1.52	0.312	19.34	15.34	7.90
250TC	7.25	8.500	0.23	9.17	0.59	1.625	3.75	1.80	0.375	19.34	15.34	7.90

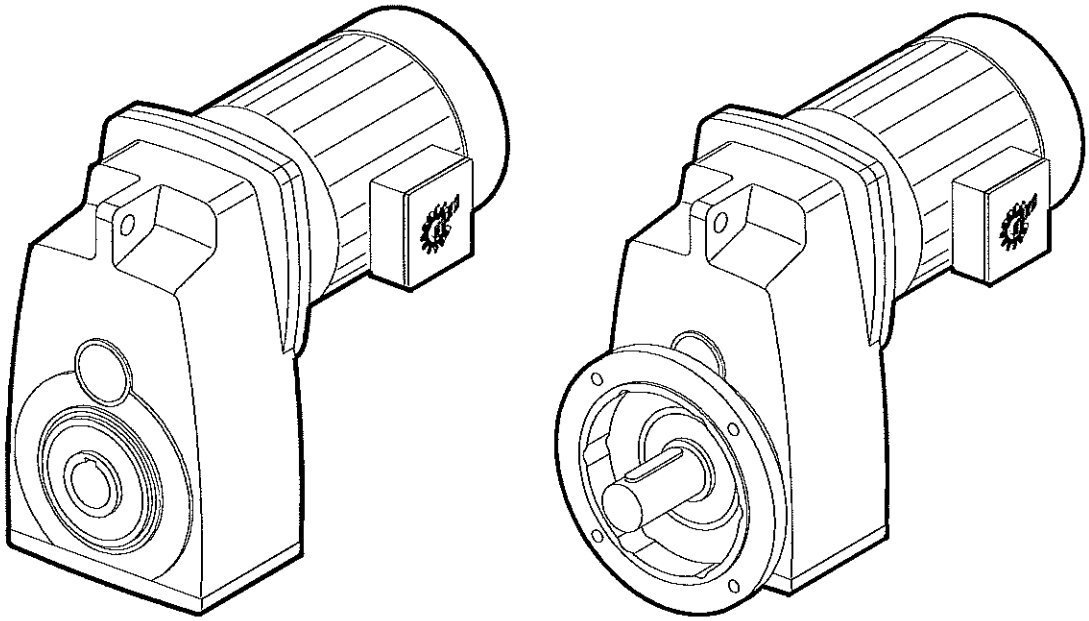
UNICASE® Shaft Mount Gearboxes
Installation and Maintenance Instructions

BIM 1020

USA

CDN

Retain These Safety Instructions For Future Use



INSPECTION OF UNIT

Thoroughly inspect the equipment for any shipping and handling damage before accepting shipment from the freight company. If any of the goods called for in the bill of lading or express receipt are damaged or the quantity is short, do not accept until the freight or express agent makes an appropriate notation on your freight bill or express receipt. If any concealed loss or damage is discovered later, notify your freight carrier or express agent at once and request him to make an inspection. We will be very happy to assist you in collecting claims for loss or damage during shipment; however, this willingness on our part does not remove the transportation company's responsibility in reimbursing you for collection of claims or replacement of material. Claims for loss or damage in shipment must not be deducted from the NORD Gear invoice, nor should payment of the NORD Gear invoice be withheld awaiting adjustment of such claims, as the carrier guarantees safe delivery.

If considerable damage has been incurred and the situation is urgent, contact the nearest NORD Gear Sales Office for assistance. Please keep a written record of all communications.

RECORD NAMEPLATE DATA

Locate the gear reducer nameplate and record all nameplate data for future reference.

SK _____ S/N _____

RATIO _____ MAX TORQUE _____ RPM _____ MTG. POS _____

STORAGE

PROPER STORAGE UNTIL INSTALLED

Keep unit in a dry, temperature controlled area. If stored other than said, long term storage methods must be applied to the unit including complete fill with lubricant. Protect machined surfaces and rotate shafts periodically. Prior to putting unit into service, drain lubricant and refill to proper level as determined by the mounting position.

PROPER HANDLING OF THE UNIT

Exercise care to prevent damage to the unit when moving. Lift only at designed lifting points. Do not attach other machinery and lift by the unit lifting points. The lifting points are to be used to lift the unit only. Insure that adequate safety measures are taken to protect personnel during transportation. Protect the mounting surface from damage.

INSTALLATION OF UNIT

To ensure long service and dependable performance, an enclosed gear drive must be rigidly supported and the shafts accurately aligned. The following describes the minimum precautions required to accomplish this end.

FOUNDATION
The responsibility for the design and construction of the foundation lies with the user. The foundation must be adequate to withstand normal operating loads and possible overloads while maintaining alignment to attached system components under such loads.

MOUNTING POSITION
Unless a unit is specifically ordered for inclined mounting, the foundation must be level and flat. The lubrication system may not operate properly if the unit is not mounted in the position for which it is designed. It may be desirable to elevate the foundation to facilitate oil drainage.

CONCRETE FOUNDATION
If a concrete foundation is used, steel mounting pads and bolts of sufficient size to distribute the stress into the concrete should be grouted into the foundation.

STEEL FOUNDATION
If a structural steel foundation is used (i.e. wide flange beams or channels), a base plate or sole plate of suitable thickness should be used and should extend under the entire unit.

FOOT MOUNTED UNITS
Use shims under the feet of the unit to align the output shaft to the driven equipment. Make sure that all feet are supported so that the housing will not distort when it is bolted down. Improper shimming will reduce the life of the unit and may cause failure. Dowel pins may be installed to prevent misalignment and ensure proper realignment if removed for service.

SHAFT MOUNTED UNITS
Shaft mounted drives should be mounted as close to the driven equipment bearing support as possible to minimize bearing loads due to overhung load. Design of the joint connection between the torque reaction arm and the foundation is the user's responsibility.

Hollow Shaft Diameter tolerance
Metric (mm)

≤ Ø 18 = +0.018/-0.000
> Ø 18 ≤ Ø 30 = +0.021/-0.000
> Ø 30 ≤ Ø 50 = +0.025/-0.000
> Ø 50 ≤ Ø 80 = +0.030/-0.000
> Ø 80 ≤ Ø 120 = +0.035/-0.000
> Ø 120 ≤ Ø 180 = +0.040/-0.000

Inch

≤ Ø 4.375 = +0.0010 / -0.0000
> Ø 4.375 = +0.0015 / -0.0000

Customer shaft diameter tolerances with keyed hollow shafts
Metric (mm)

≤ Ø 18 = +0.000/-0.011
> Ø 18 ≤ Ø 30 = +0.000/-0.013
> Ø 30 ≤ Ø 50 = +0.000/-0.016
> Ø 50 ≤ Ø 80 = +0.000/-0.019
> Ø 80 ≤ Ø 120 = +0.000/-0.022
> Ø 120 ≤ Ø 180 = +0.000/-0.025

Inch

≤ Ø 1.500 = +0.000/-0.002
> Ø 1.500 ≤ Ø 2.500 = +0.000/-0.003
> Ø 2.500 ≤ Ø 7.000 = +0.000/-0.004

Shaft finish to be 125 micro inches or smoother.

Customer shaft diameter tolerance with Shrink Disc fit h6
Metric (mm)

≤ Ø 18 = +0.000/-0.011
> Ø 18 ≤ Ø 30 = +0.000/-0.013
> Ø 30 ≤ Ø 50 = +0.000/-0.016
> Ø 50 ≤ Ø 80 = +0.000/-0.019
> Ø 80 ≤ Ø 120 = +0.000/-0.022
> Ø 120 ≤ Ø 180 = +0.000/-0.025

Inch

≤ Ø 0.750 = +0.0000/-0.0004
> Ø 0.750 ≤ Ø 1.125 = +0.0000/-0.0005
> Ø 1.125 ≤ Ø 2.000 = +0.0000/-0.0006
> Ø 2.000 ≤ Ø 3.000 = +0.0000/-0.0007
> Ø 3.000 ≤ Ø 4.750 = +0.0000/-0.0008
> Ø 4.750 ≤ Ø 7.000 = +0.0000/-0.0010

Shaft finish to be 125 micro inches or smoother.

Customer shaft diameter tolerance with Shrink Disc fit f6 (looser fit)
Metric (mm)

≤ Ø 18 = -0.016/-0.024
> Ø 18 ≤ Ø 30 = -0.020/-0.029
> Ø 30 ≤ Ø 50 = -0.025/-0.036
> Ø 50 ≤ Ø 80 = -0.030/-0.043
> Ø 80 ≤ Ø 120 = -0.036/-0.051
> Ø 120 ≤ Ø 180 = -0.043/-0.061

Inch

≤ Ø 0.750 = -0.0006/-0.0011
> Ø 0.750 ≤ Ø 1.125 = -0.0008/-0.0013
> Ø 1.125 ≤ Ø 2.000 = -0.0010/-0.0016
> Ø 2.000 ≤ Ø 3.000 = -0.0012/-0.0019
> Ø 3.000 ≤ Ø 4.750 = -0.0014/-0.0023
> Ø 4.750 ≤ Ø 7.000 = -0.0017/-0.0027

Shaft finish to be 125 micro inches or smoother

FLANGE MOUNTED UNITS
If a structural steel foundation is used (i.e. wide flange beams or channels), a base plate or sole plate of suitable thickness should be used and should extend under the entire unit. If a bulk head plate is used it should be of proper strength to minimize buckling distortions.

Flange Pilot 'AK' or 'AK1' tolerance
Metric (mm)

> Ø 50 ≤ Ø 80 = +0.012/-0.007
> Ø 80 ≤ Ø 120 = +0.013/-0.009
> Ø 120 ≤ Ø 180 = +0.014/-0.011
> Ø 180 ≤ Ø 230 = +0.016/-0.013
> Ø 230 ≤ Ø 315 = +0.000-0.032
> Ø 315 ≤ Ø 400 = +0.000/-0.036
> Ø 400 ≤ Ø 500 = +0.000/-0.040

Inch

> Ø 1.969 ≤ Ø 3.150 = +0.005/-0.0003
> Ø 3.150 ≤ Ø 4.724 = +0.005/-0.0004
> Ø 4.724 ≤ Ø 7.087 = +0.006/-0.0004
> Ø 7.087 ≤ Ø 9.055 = +0.006/-0.0005
> Ø 9.055 ≤ Ø 12.402 = +0.000/-0.0013
> Ø 12.402 ≤ Ø 15.748 = +0.000/-0.0014
> Ø 15.748 ≤ Ø 19.685 = +0.000/-0.0016

BOLT STRENGTH
Bolt size, strength and quantity should be verified to insure proper torque reaction capacity whatever the mounting arrangement.

LUBRICATE SHAFTS
Both the hollow shaft and the driven shaft should be liberally lubricated before assembly. The unit must slide freely onto the driven shaft. Do not hammer or force the unit into place. For shrink disc, follow instructions below.

AXIAL RETENTION
Each drive shaft must be retained in place relative to the gear reducer. Or each gear reducer must be retained in place relative to the drive shaft. Either way NORD recommends the use of shaft shoulders, locking collars or FIXING ELEMENTS to axially retain the shaft or gear reducer in position.

SET SCREWS
If set screws are used for axial retention, they should be tightened evenly. Flats may be filed on the driven shaft and a thread-locking adhesive used for more position retention.

SNAP RING RETENTION
Placing external snap rings on drive shafts must be performed with caution. The groove, which the snap ring fits into, may weaken the drive shaft causing premature failure. NORD does not recommend this type of shaft retention.

THRUST PLATE
In applications, which are subject to high vibratory loads, a thrust plate will provide greater resistance to axial movement. Follow the manufacturer's recommendations for assembly.

SHRINK DISC
If a shrink disc is used to secure a reducer hollow shaft to the driven shaft, follow this assembly procedure. Start with the shrink disc mounted onto the extension of the hollow shaft disc locking bolts loosened.

1. Clean reducer bore and mating solid shaft to be free of any lubricants or dirt.
2. Slide reducer onto the solid shaft until it is about half way through.
3. Lubricate the remaining portion of the solid shaft with a #2 grease or similar lubricant. This part will be located under the bronze bushing. **Do not install grease under the shrink disc gripping area.** Finish installing the solid shaft into the reducer hollow bore.
4. Finger tighten all shrink disc bolts. Now, moving a circular pattern, tighten each shrink disc locking bolt 1/4 to 1/2 turn. **Do not use criss cross pattern.** Continue tightening in the same circular direction with 1/4 or 1/2 turn increments until all bolts reach the specified bolt tightening torque. Bolt tightening torque is shown on the shrink disc label for the particular unit.
5. Run unit for 24 hours, then retighten shrink disc locking bolts to the proper bolt torque as indicated above.

TORQUE REACTION ARM
On the shaft mount 'Clincher', torque is reacted through the integral torque tab, which is part of the casting. Commonly, NORD's optional RUBBER BUFFER bushings are installed on each side of the integral torque tab to dampen torque shocks and allow for mis-alignment received from the machinery during operation.

Torque arm connection fabrications should always be mounted perpendicular to a line through the output shaft center and the point at attachment of the torque arm to the unit housing. In this position the minimum load on the attachment structure arm will be experienced. The attachment structure must be rigid and may not deflect under any load. Doing so will place extra loads on the output bearings of the reducer.

PRIME MOVER MOUNTING
Align the prime mover to the reducer-input shaft using shims under the feet. Make sure that the feet are supported. Dowel the prime mover to its foundation.

SHAFT CONNECTIONS
When connecting shafts to either the input or output of the reducer, consider the following instructions.

FITS
Clearance or interference fits for coupling hubs should be in accordance with ANSI/AGMA 9002-A86 or as follows.

Output and Input shaft Diameter tolerance
Metric (mm)

≤ Ø 18 = +0.012/+0.001
> Ø 18 ≤ Ø 30 = +0.015/+0.002
> Ø 30 ≤ Ø 50 = +0.018/+0.002
> Ø 50 ≤ Ø 80 = +0.030/+0.011
> Ø 80 ≤ Ø 120 = +0.035/+0.013
> Ø 120 ≤ Ø 180 = +0.040/+0.015

Inch

≤ Ø 1.750 = +0.0000/-0.0005
> Ø 1.750 = +0.0000/-0.0010

Output and Input shaft Drill and tap shaft end
Metric (mm)

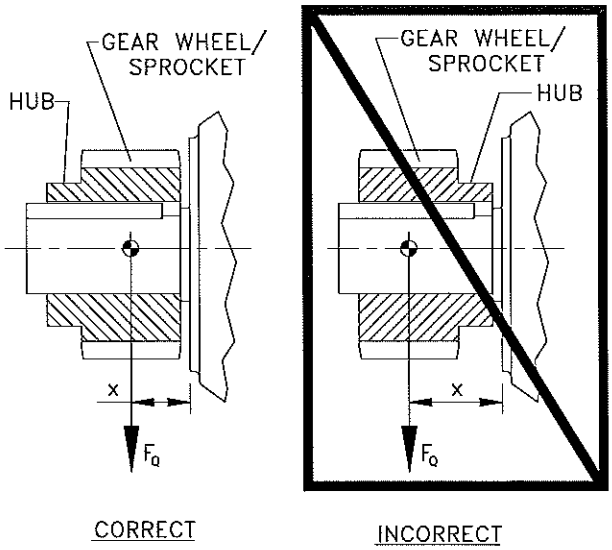
≤ Ø 16 = M5
> Ø 16 ≤ Ø 21 = M6
> Ø 21 ≤ Ø 24 = M8
> Ø 24 ≤ Ø 30 = M10
> Ø 30 ≤ Ø 38 = M12
> Ø 38 ≤ Ø 50 = M16
> Ø 50 ≤ Ø 85 = M20
> Ø 85 ≤ Ø 130 = M24

Inch

≤ Ø 0.438 = #10-24 x 0.4 deep
> Ø 0.438 ≤ Ø 0.813 = 1/4-20 x 0.6 deep
> Ø 0.813 ≤ Ø 0.938 = 5/16-18 x 0.7 deep
> Ø 0.938 ≤ Ø 1.125 = 3/8-16 x 0.9 deep
> Ø 1.125 ≤ Ø 1.375 = 1/2-13 x 1.1 deep
> Ø 1.375 ≤ Ø 1.875 = 5/8-11 x 1.4 deep
> Ø 1.875 ≤ Ø 3.250 = 3/4-10 x 1.7 deep
> Ø 3.250 = 1-8 x 2.2 deep

Outboard pinion and sprocket fits should be as recommended by the pin sprockets with interference fits should be heated according to the manufacturer's recommendations, generally 250°F to 300°F, (120°C to 150° C) before assembling to the shaft.

LOCATION
Coupling hubs should be mounted flush with the shaft ends, unless specifically ordered for overhung mounting. Pinions,



sprockets and sheaves should be mounted as close as possible to the unit housing to minimize bearing loads and shaft deflections.

COUPLING ALIGNMENT
Shaft couplings should be installed according to the coupling manufacturer's recommendations for gap, angular and parallel alignment. In many installations, it is necessary to allow for thermal and mechanical shaft movement when determining shaft alignment. The coupling manufacturer's recommendations should be followed.

AXIAL DISPLACEMENT
The gap between shaft ends should be the same as the specified coupling gap unless overhung mounting of the coupling hub is specified. The coupling gap and shaft gap must be sufficient to accommodate any anticipated thermal or mechanical axial movement.

ANGULAR ALIGNMENT
Insert a spacer or shim stock equal to the required coupling gap between the coupling hub faces and measure the clearance using feeler gauges. Repeat this at the same depth at 90-degree intervals to determine the amount of angular misalignment.

PARALLEL ALIGNMENT
Mount a dial indicator to one coupling hub, and rotate this hub, sweeping the outside diameter of the other hub. The parallel misalignment is equal to one-half of the total indicator reading. Another method is to rest a straight edge squarely on the outside diameter of the hubs at 90-degree intervals and measure any gaps with feeler gauges. The maximum gap measurement is the parallel misalignment.

CHECKING ALIGNMENT
After both angular and parallel alignments are within specified limits, tighten all foundation bolts securely and repeat the above procedure to check alignment. If any of the specified limits for alignment are exceeded, realign the coupling.

SPROCKET OR SHEAVE ALIGNMENT
Align the sheaves or sprockets square and parallel by placing a straight edge across their faces. Alignment of bushed sheaves and sprockets should be checked after bushings have been tightened. Check horizontal shaft alignment by placing a level vertically against the face of the sheave or sprocket. Adjust belt or chain tension per the manufacturer's specified procedure.

OUTBOARD PINION ALIGNMENT
Align the pinion by adjusting the gear tooth clearance according to the manufacturer's recommendations and checking for acceptable outboard pinion tooth contact. The foundation bolts may have to be loosened and the unit moved slightly to obtain this contact. When the unit is moved to correct tooth contact, the prime mover should be realigned.

RECHECK ALIGNMENT
After a period of operation, recheck alignment and adjust as required.

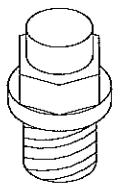
1. Properly install unit on a rigid foundation
   - adequately supported
   - securely bolted into place
   - leveled so as not to distort the gear case
2. Properly install couplings suitable for the application and connected equipment.
3. Ensure accurate alignment with other equipment.
4. Furnish and install adequate machinery guards as needed to protect operating personnel and as required by the applicable standards of the Occupational Safety and Health Administration (OSHA), and by other applicable safety regulations;
5. Ensure that driving equipment is running in the correct direction before coupling to reducers with backstops (designed to operate only in a specific direction) or machinery designed to operate only in one direction.

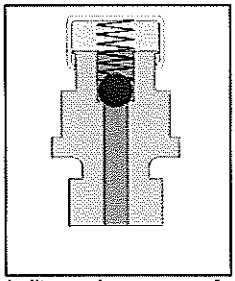
CHANGES IN PERFORMANCE SPECIFICATIONS
Owner has the responsibility to consult with NORD GEAR if such items such as applied loads, operating speeds or other operating conditions have changed.

⚠ WARNING:
LOCK OUT POWER before any maintenance is performed. Make absolutely sure that no voltage is applied while work is being done on the gearbox.

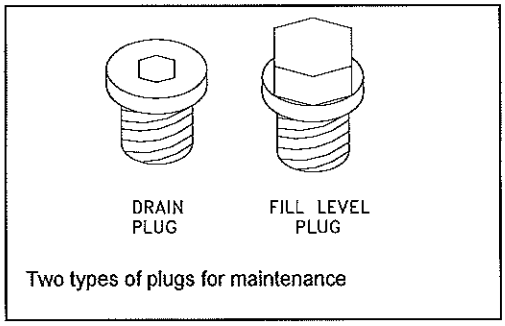
START-UP
1. Ensure that switches, alarms, heaters, coolers and other safety and protection devices are installed and operational for their intended purpose.
2. Verify that the installed mounting position is the same as the nametag mounting position. If not, adjust the oil level accordingly and relocate the vent plug, fill plug and drain plug according to the mounting position. See following.

AUTOVENT PLUG
The Autovent plug is brass in color and will be located at the highest point on the gearbox. It operates like a check-valve to allow the reducer to relieve internal pressure while preventing lubricant contamination during cooling. A spring presses a ball or plunger against a machined orifice until pressure exceeds 2 psi. Above 2 psi the air is allowed to escape depressurizing the gearcase. When internal pressure drops below 2 psi, the autovent re-seals closing the unit to the outside environment. After shutdown, the reducer cools along with the air inside the reducer. The unit will temporarily maintain a slight vacuum until normalization occurs. NORD Gear supplies an Autovent as a standard feature.


AUTOVENT PLUG


The Autovent releases built-up air pressure from inside the gearbox (Max. pressure 2 psi).

FILL LEVEL & DRAIN PLUGS
The drain plugs are metric socket head cap screws. They will be located at the lowest part of the gearbox for ease of draining. The fill level plug is a hex head cap screw. It will be located between the Autovent and drain plug. Both types of plugs will have gaskets included to prevent oil from leaking.



Two types of plugs for maintenance

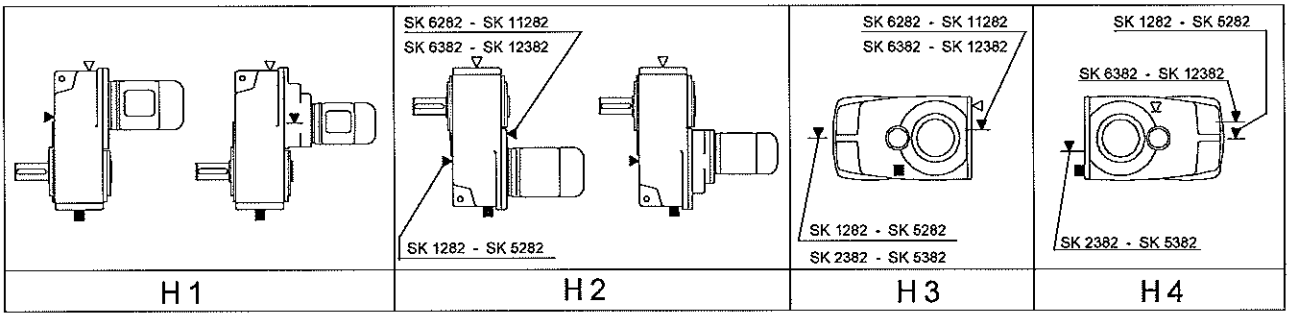
LUBRICANT
All NORD reducers are shipped from the factory properly filled with lubricant and all plugs are installed according to the mounting position given on the reducer nametag. Acceptable oil fill level is within ½ inch of the bottom of the fill plug threads.

OPERATION AND MAINTENANCE CHECKLIST
1. Operate the equipment as it was intended to be operated
2. Do not overload.
3. Run at correct speed.
4. Maintain lubricant in good condition and at proper level.
5. Dispose of used lubricant in accordance with applicable laws and regulations.
6. Apply proper maintenance to attached equipment at prescribed intervals recommended by the manufacturer.
7. Perform periodic maintenance of the gear drive as recommended by NORD.

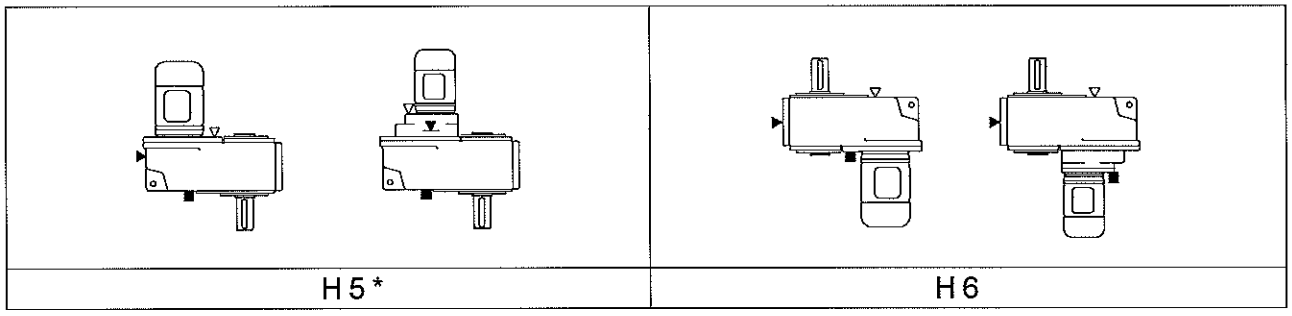
MOUNTING POSITIONS

These charts detail the mounting positions for horizontal and vertical mounting. The Autovent, oil fill plug and drain plug are indicated on each mounting position picture. The factory set mounting position and plug locations match that shown on the gearbox nametag. For mounting orientations other than shown consult NORD Gear.

Horizontal position



Vertical position



Symbols: Vent plug Oil level Drain plug

* Mounting position H5 with lubricant expansion unit recommended

~~**SK0182NB & SK1382NB have no vent or drain plugs. They are filled with synthetic oil so the units are "Lubed for Life".**~~

MAINTENANCE

Mineral lubricant should be changed every 10,000 service hours or after two years. For synthetic oils, the lube should be changed every 20,000 service hours or after four years. In case of extreme operating (e.g. high humidity, aggressive environment or large temperature variations), shorter intervals between changes are recommended.

OIL SPECIFICATIONS

NORD supplies all reducers filled with oil from the factory. Consult the sticker adjacent to the fill plug to determine the type of lubricant installed at the factory. Standard lubricant is ISO VG220 mineral-based oil. However, some units have special lubricants designed to operate in certain environments or to extend the service life of the lubricant. If in doubt about which lubricant is needed, contact NORD Gear.

STANDARD OIL – ISO VG220

Ambient Temperature	Formulation
20 to 104°F (-5 to 40°C)	Mineral

TYPICAL OILS

Viscosity ISO NLGI	Formulation	Service Temperature Range	Mobil®	Shell	Castrol	KLÜBER LUBRICATION	bp	Tribol®
VG 460	Conventional Mineral	20°C to +50°C 68F to +122°F	Mobilgear 634	Omala 460	7EP	Klüberoil GEM 1-460	Energol GR-XP 460	Tribol 1100/460
	Synthetic PAO	-30°C to +80°C -22°F to +176°F	Mobil SHC 634	Omala 460 HD	Isolube EP 460	Klübersynth EG 4-460	N/A	Tribol 1510/460
VG 320	Conventional Mineral	0°C to +30°C 32°F to +86°F	Mobilgear 632	Omala 320	6EP	Klüberoil GEM 1-320	Energol GR-XP 320	Tribol 1100/320
	Synthetic PAO	-35°C to +80°C -31°F to +176°F	Mobil SHC 632	Omala 320 HD	Isolube EP 460	Klübersynth EG 4-320	N/A	Tribol 1510/320
VG 220	Conventional Mineral	-5°C to +40°C +20°F to +104°F	Mobilgear 630	Omala 220	5EP	Klüberoil GEM 1-220	Energol GR-XP 220	Tribol 1100/220
	Synthetic PAO	-34°C to +80°C -30°F to +176°F	Mobil SHC 630	Omala 220 HD	Isolube EP 220	Klübersynth EG 4-220	N/A	Tribol 1510/220
VG 150 & VG 100	Conventional Mineral	-15°C to +25°C 5°F to +77°F	Mobilgear 629	Omala 100	4EP	Klüberoil GEM 1-150	Energol GR-XP 100	Tribol 1100/100
	Synthetic PAO	-37°C to +10°C -35°F to +50°F	Mobil SHC 629	Omala 150 HD	Isolube EP 150	Klübersynth EG 4-150	N/A	N/A
VG 68	Conventional Mineral	-15°C to +25°C 5°F to +77F	Mobilgear 626	Omala 68	2EP	Klüberoil GEM 1-68	Energol GR-XP 68	Tribol 1100/68
	Synthetic PAO	-40°C to +10°C -40°F to +50F	Mobil SHC 626	N/A	Isolube EP 68	N/A	N/A	N/A
VG 32	Synthetic PAO	-40°C to +10°C -40°F to +50°F	Mobil SHC 624	N/A	N/A	Klüber-Summit HySyn FG-32	N/A	N/A

PAO = Poly Alpha Olefin

SPECIAL PURPOSE LUBRICANTS

Ambient Temperature	Formulation	Manufacturer	Oil Brand Name
20 to 104°F (-5 to 40°C)	*Food Grade* Oil - Synthetic	Chevron	FM ISO 220
20 to 104°F (-5 to 40°C)	*Food Grade* Oil - Synthetic	OilJAX	Magnaplate 85W140-FG
5 to 125°F (-20 to 50°C)	Fluid Grease	Mobil	Mobilux EP023
-30 to 140°F (-35 to 60°C)	Fluid Grease - Synthetic	Mobil	Mobilith SHC 007
-30 to 140°F (-35 to 60°C)	Fluid Grease - Synthetic	Shell	Albida LC

STANDARD BEARING GREASE – NLGI 2EP Lithium

Ambient Temperature	Formulation
-20 to 140°F (-30 to 60°C)	Mineral

OPTIONAL BEARING GREASES

Ambient Temperature	Formulation	Manufacturer	Grease Brand Name
-40 to 230°F (-40 to 110°C)	Synthetic	Shell	Aeroshell 6
-40 to 230°F (-40 to 110°C)	*Food Grade* - Synthetic	Lubriplate	SFL1

LUBRICANT CAPACITY

Each reducer has the oil level and oil quantity adjusted according to the mounting position shown in the tables. When replacing the oil, consult the tables below to determine the proper amount of oil to be installed according to the reducer size and mounting position. Note that this is approximate and the final level will be adjusted when the reducer is installed. Acceptable oil fill level is within ½ inch of the bottom of the fill plug threads.

LUBRICATION CAPACITY - SHAFT MOUNT 'CLINCHER' GEARBOXES

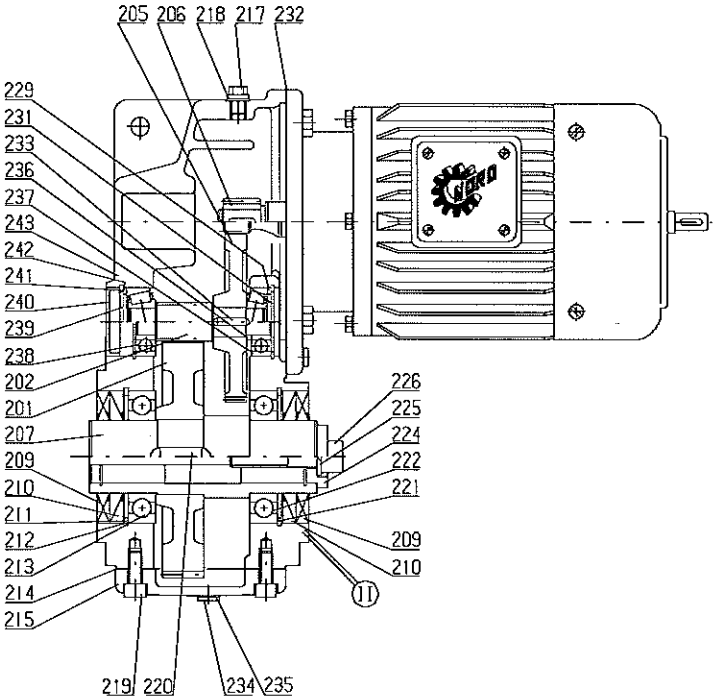
		MOUNTING POSITION					
		Horizontal				*Vertical*	
		H1	H2	H3	H4	H5	H6
SK 0182NB	quarts	0.42	0.63	0.53	0.53	0.58	0.58
	liters	0.40	0.60	0.50	0.50	0.55	0.55
SK0282NB	quarts	0.74	0.85	0.95	0.95	1.16	1.06
	liters	0.70	0.80	0.90	0.90	1.10	1.00
SK 1282	quarts	0.95	0.95	1.00	1.00	1.27	1.37
	liters	0.90	0.90	0.95	0.95	1.20	1.30
SK 2282	quarts	1.74	2.01	1.90	1.90	2.11	2.54
	liters	1.65	1.90	1.80	1.80	2.00	2.40
SK 3282	quarts	3.33	3.44	3.33	3.33	4.33	4.33
	liters	3.15	3.25	3.15	3.15	4.10	4.10
SK 4282	quarts	4.97	5.02	4.97	4.97	5.71	6.45
	liters	4.70	4.75	4.70	4.70	5.40	6.10
SK 5282	quarts	7.93	7.93	7.61	7.61	9.30	9.30
	liters	7.50	7.50	7.20	7.20	8.80	8.80
SK 6282	quarts	18.0	12.7	14.8	10.6	18.5	14.8
	liters	17.0	12.0	14.0	10.0	17.5	14.0
SK 7282	quarts	26.4	21.1	22.2	16.9	28.5	22.2
	liters	25	20	21	16	27	21
SK 8282	quarts	39.1	31.7	32.8	32.8	43.3	34.9
	liters	37	30	31	31	41	33
SK 9282	quarts	78.2	58.1	62.4	72.9	76.1	74.0
	liters	74	55	59	69	72	70
SK 10282	quarts	95	42	87	63	95	95
	liters	90	40	82	60	90	90
SK 11282	quarts	174	153	148	106	206	169
	liters	165	145	140	100	195	160

		MOUNTING POSITION					
		Horizontal				*Vertical*	
		H1	H2	H3	H4	H5	H6
SK 1382NB	quarts	1.37	1.48	2.01	2.11	2.22	2.43
	liters	1.30	1.40	1.90	2.00	2.10	2.30
SK 2382	quarts	1.80	2.01	1.59	1.59	3.28	2.75
	liters	1.70	1.90	1.50	1.50	3.10	2.60
SK 3382	quarts	4.33	3.49	3.49	3.49	5.92	4.33
	liters	4.10	3.30	3.30	3.30	5.60	4.10
SK 4382	quarts	6.24	5.18	5.18	5.18	8.77	7.19
	liters	5.90	4.90	4.90	4.90	8.30	6.80
SK 5382	quarts	13.21	7.08	8.77	8.77	14.80	12.68
	liters	12.50	6.70	8.30	8.30	14.00	12.00
SK 6382	quarts	17.4	10.1	13.2	14.8	19.0	13.7
	liters	16.5	9.6	12.5	14.0	18.0	13.0
SK 7382	quarts	23.3	16.9	20.1	24.3	26.4	21.1
	liters	22	16	19	23	25	20
SK 8382	quarts	35.9	26.4	31.7	37.0	40.2	33.8
	liters	34	25	30	35	38	32
SK 9382	quarts	77.2	47.6	63.4	68.7	78.2	74.0
	liters	73	45	60	65	74	70
SK 10382	quarts	90	77	85	85	93	93
	liters	85	73	80	80	88	88
SK 11382	quarts	169	148	143	164	222	164
	liters	160	140	135	155	210	155
SK 12382	quarts	169	148	143	164	222	164
	liters	160	140	135	155	210	155

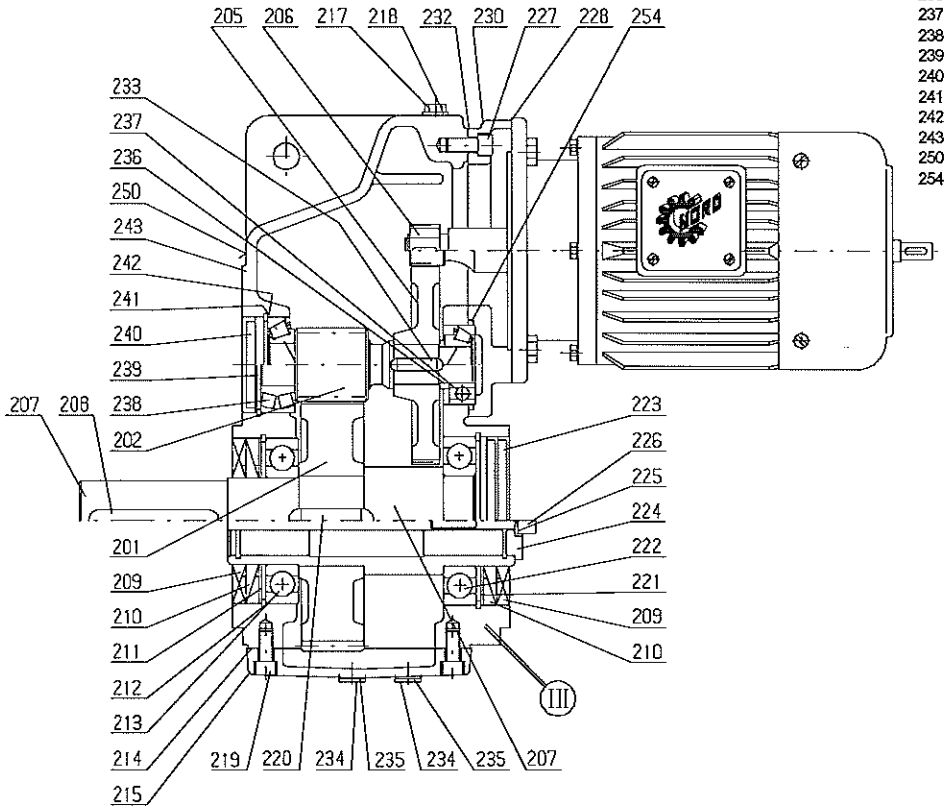
Note: Filling quantities are approximate figures. Oil level must be checked according to oil level plug after final installtion.
Acceptable oil fill level is within 1/2 inch of the bottom of the fill plug threads. For mounting angles not shown, consult factory.

PARTS LIST

SK1282 - SK5282



SK6282 - SK11282



201	Driven gear
202	Pinion shaft
205	Driving gear
206	Driving pinion
207	Output shaft (Hollow shaft)
208	Key
209	Shaft seal
210	Shaft seal
211	Circlip
212	Shim
213	Ball bearing
214	Seal
215	Gear case cover
217	Vent plug
218	Seal
219	Socket head screw
220	Key
221	Circlip
222	Ball bearing
223	Locking cap
224	Washer
225	Washer
226	Socket head screw
227	Socket head screw
228	Seal
229	Supporting disc
230	Gearbox cover
231	Circlip
232	Seal
233	Key
234	Drain plug
235	Seal
236	Supporting disc
237	Pinion shaft bearing
238	Pinion shaft bearing
239	Circlip
240	Locking cap
241	Shim
242	Supporting disc
243	Gear case
250	Locking cap
254	Spacer

RECOMMENDED SPARE PARTS

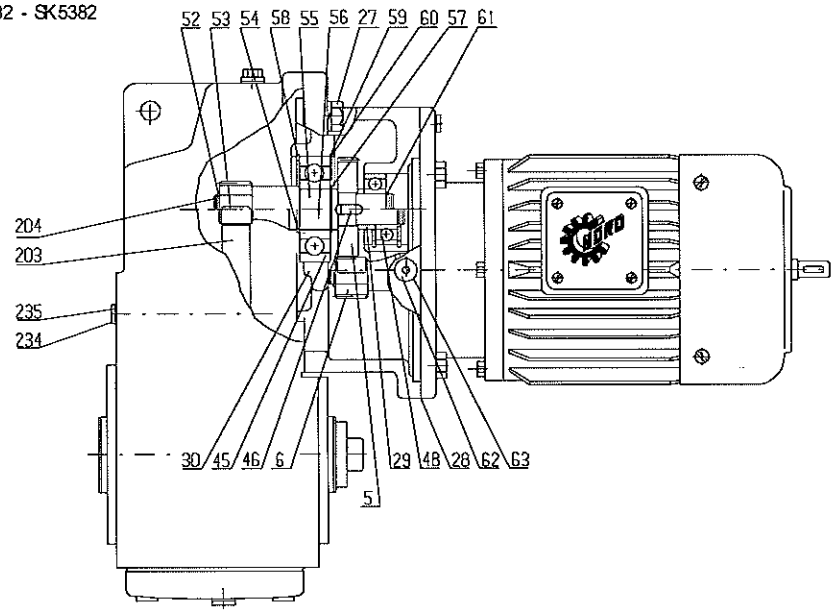
Bearings – *all* Gaskets – *all* Shims – *all*
Seals – *all* Seal Plugs – *all*

IMPORTANT!

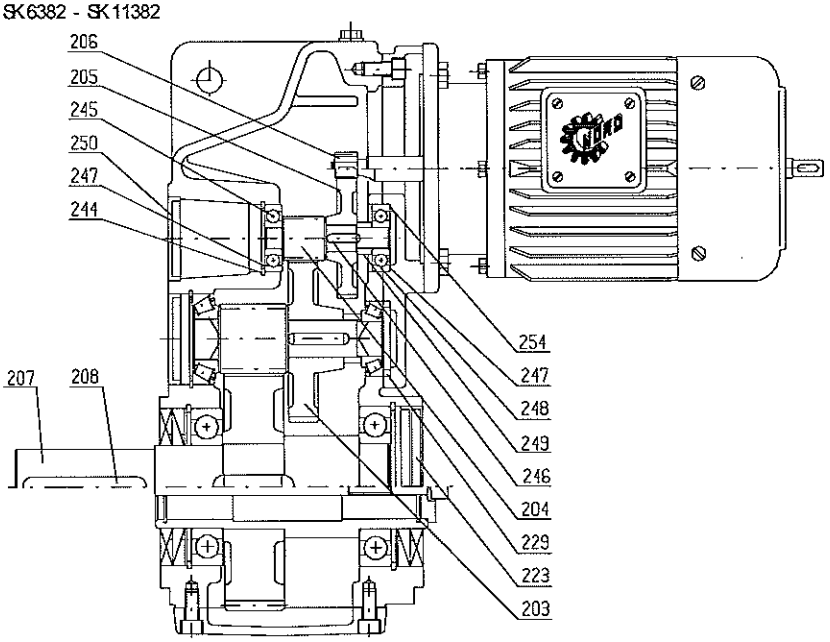
When ordering parts, it is necessary to have the *NORD SERIAL NUMBER* from the unit the parts are for. The serial number will dictate the correct parts for that particular unit. The gearbox nameplate will have the serial number on it.

PARTS LIST

SK1382 - SK5382



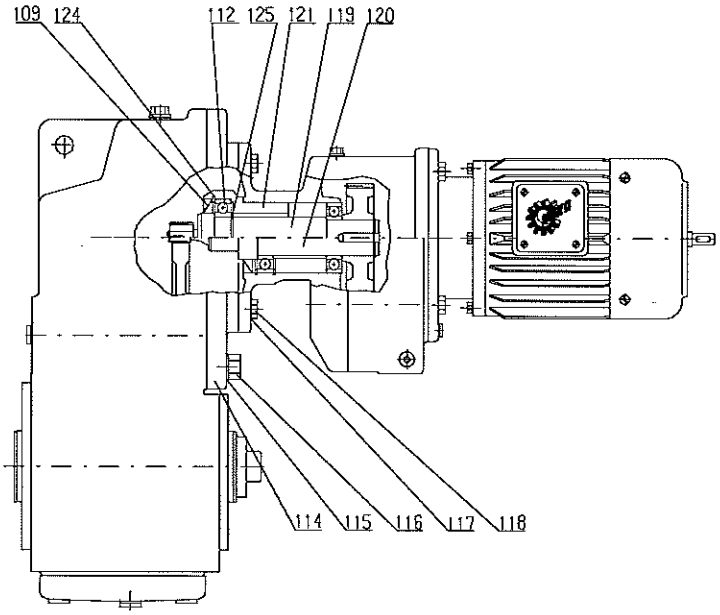
SK6382 - SK11382



5	Driving gear
27	Hexagon screw
28	Seal
29	Supporting disc
30	Third reduction gearcase
45	Ball bearing
46	Key
48	Ball bearing
52	Circlip
53	Key
54	Circlip
55	Intermediate shaft, plain
56	Intermediate shaft, gearcut
57	Circlip
58	Circlip
59	Shim
60	Circlip
61	Circlip
62	Drain plug
63	Seal
203	Driving gea
204	Pinion shaft SK6382 - SK9382
206	Driving pinion
207	Output shaft
208	Key
223	Locking cap
229	Supporting disc
234	Drain plug
235	Seal
244	Circlip
245	Ball bearing
246	Key
247	Shim
248	Ball bearing
249	Supporting disc
250	Locking cap
254	Spacer

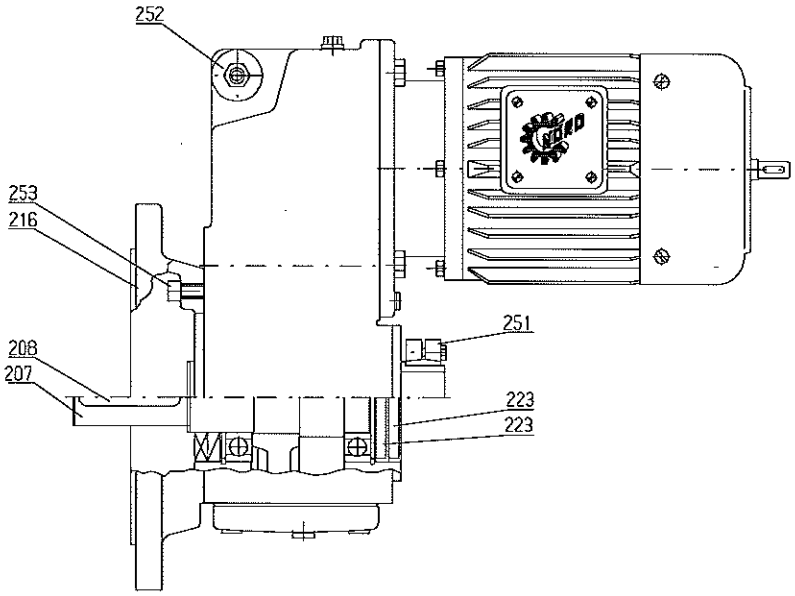
PARTS LIST

SK1282/02 - SK11382/52



109 Shaft seal
112 Ball bearing
114 Intermediate flange
115 Washer
116 Hexagon screw
117 Washer
118 Hexagon screw
119 Intermediate shaft, plain
120 Intermediate shaft, gearcut
121 Bearing sleeve
124 Circlip
125 Circlip
207 Output shaft
208 Key
216 Flange
223 Locking cap
251 Shrink disc connector
252 Torque arm
253 Socket head screw

SK1282 - SK11282
SK1382 - SK11382



TROUBLE SHOOTING

PROBLEM WITH THE REDUCER		POSSIBLE CAUSES	SUGGESTED REMEDY
Runs Hot	Overloading	Load exceeds the capacity of the reducer	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce load
	Improper lubrication	Insufficient lubrication	Check lubricant level and adjust up to recommended levels
		Excessive lubrication	Check lubricant level and adjust down to recommended levels
		Wrong lubrication	Flush out and refill with correct lubricant as recommended
Runs Noisy	Loose foundation bolts	Weak mounting structure	Inspect mounting of reducer. Tighten loose bolts and/ or reinforce mounting and structure
		Loose hold down bolts	Tighten bolts
	Worn RV Disc	Overloading unit may result in damage to disc	Disassemble and replace disc. Recheck rated capacity of reducer.
	Failure of Bearings	May be due to lack of lubricant	Replace bearing. Clean and flush reducer and fill with recommended lubricant.
		Overload	Check rated capacity of reducer.
	Insufficient Lubricant	Level of lubricant in the reducer not properly maintained.	Check lubricant level and adjust to factory recommended level.
Output Shaft Does Not Turn	Internal parts are broken	Overloading of reducer can cause damage.	Replace broken parts. Check rated capacity of reducer.
		Key missing or sheared off on input shaft.	Replace key.
		Coupling loose or disconnected.	Properly align reducer and coupling. Tighten coupling.
Oil Leakage	Worn Seals	Caused by dirt or grit entering seal.	Replace seals. Autovent may be clogged. Replace or clean.
		Overfilled reducer.	Check lubricant level and adjust to recommended level.
		Autovent clogged.	Clean or replace, being sure to prevent any dirt from falling into the reducer.
		Improper mounting position, such as wall or ceiling mount of horizontal reducer.	Check mounting position. Name tag & verify with mounting chart in manual.

NORD Gear Corporation
National Customer Service Toll Free 888-314-6673
www.nord.com

NORD Gear Limited
Toll Free in Canada 800-668-4378

WEST
1121 Railroad Street
Building 101
Corona, CA 92882
Phone 951-279-2600
Fax 888-408-6673

MIDWEST
PO Box 367
800 Nord Drive
Waunakee, WI 53597
Phone 608-849-7300
Fax 800-373-6673

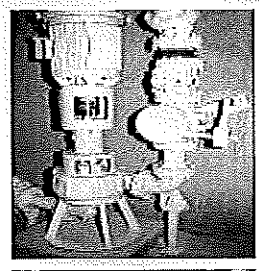
SOUTH
100 Forsyth Hall Dr.
Building 100B
Charlotte, NC 28273
Phone 704-529-1255
Fax 888-259-6673

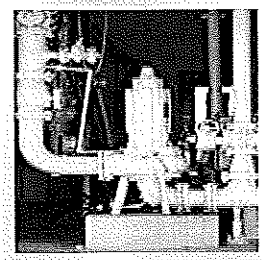
CANADA
41 West Drive
Brampton, Ontario L6T 4A1
Phone 905-796-3606
Fax 905-796-8130

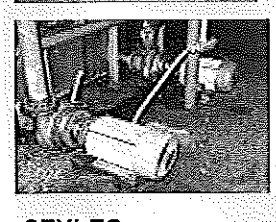
PUMP

ESSCO

Reliable Long-Term Solutions For Your Toughest Pump





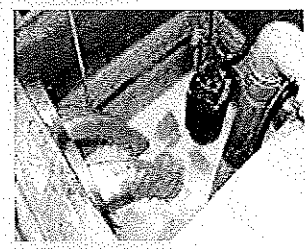


STYLES
- Horizontal with Power Frame
- Horizontal Close Coupled
- Vertical with Power Frame
- Vertical Close Coupled
- Vertical Dry Pit with Submersible Motor
- Submersible
- Column

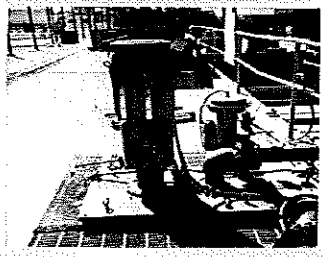
SIZES
- 1" Thru 6" Vortex
- 3" Thru 12" Non-Clog

Municipal
- Raw Sewage
- Grit Handling
- Sludge Recirculation
- Digester Cleaning
- Thickened Sludge
- Storm Water
- Sump Pump (Pipe Gallery)
- Head Works

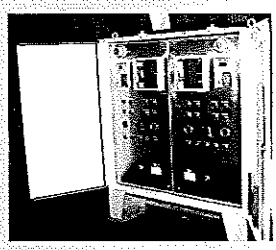
Industrial
- Coal Wash
- Coal Pile Runoff
- Coal Slurry
- Citrus Waste Handling
- Sugar Waste Handling
- Leather Tannery Waste
- Rendering
- Plant Wash Down
- Clarifier Under Flow
- Stone Washed Jeans
- Industrial Laundries
- Automobile Shredding



MATERIALS
- Cast Iron
- Stainless Steel
- Ni-Hard
- High Chrome Iron (HCI)
- 20+ Other Alloys



U.L. LISTED CUSTOM CONTROL PANELS
- Air Bubbler– Pressure Switch
- Air Bubbler--Transducer
- Float Switch
- Variable Speed Drive Systems
- Sonic Level Controllers
- Motor Control Centers
- PLC Controls
- Calibration Test Benches
- Custom NEMA Enclosures in Epoxy Coated Steel and Stainless Steel



ESSCO Pumps & Controls

4935 Telegraph Rd.
Los Angeles, Ca 90022

(323) 261-2181
Fax (323) 261-1523

Website: www.esscopumps.com
Email: sales@esscopumps.com

Member of the Hydraulic Institute

Form G-01a

ESSCO

ENGINEERS SALES-SERVICE COMPANY, INC.

4935 Telegraph Rd. ! Los Angeles, CA 90022
Phone (323)261-2181 FAX (323)261-1523

- Submittal -

Quote No: **JR11052S** **July 15, 2011**

Attention: **Chuck Schloss**
Firm: **Schloss Engineered Equipment**

Ref: **Fountain, Colorado**
Grit Pumps:GP-1& GP-2

ESSCO Pumps & Controls is pleased to quote the following pumping equipment:

CONDITION POINT: **220 GPM at 28 FT. TDH**

Two - **ESSCO** model 4x16 HDPL large power frame heavy duty horizontal pump with a **recessed vortex style Cupped impeller,** dynamically balanced in two planes, capable of passing 4" diameter and long length solids. **Each unit shall be constructed of heavy duty engineered Ni-Hard 650** with Ni-Hard 650 impeller, Ni-Hard 650 volute, Ni-Hard 650 suction cover, Ni-Hard 650 wear plate, **Cast Iron seal box with a single inside Silicon Carbide mechanical seal** and Buna-N seal elastomers, with oil lubricated bearings w/ **oiler sight glass,** heavy duty Steel pump shaft, and 416 Stainless Steel shaft sleeve. The pump shall be fitted with a .5" vent.

Each pump shall include the following:
- A coating of standard factory paint.
- Side x Side belt drive system with 316 SS belt guard.
- Reliance brand TEFC, Explosion Proof Energy Efficient motor rated for 7.5 HP, 1150 RPM, 460Volts/3Phase/60hz., with Class F insulation
- Certified Performance test
- One Set Spare parts:
  - 1-Nihard wear plate
  - 1-set-pump bearings
  - 1-Silicon carbide seal
  - 1-set-V-belts

As always, if I can be of further service please feel free to contact me.

Respectfully,
Jon Rogers
ESSCO Pumps & Controls

Horizontal Recessed Impeller Pump Data Sheet

PUMP

Job Number:	JR11052S
Attention:	Chuck Schloss
Firm Name:	Schloss Engineered Equipment
Reference:	Fountain, Colorado Grit Pumps: GP-1& GP-2
GPM:	220
TDH:	28 ft.
Pump Quantity:	Two
Model:	4x16
Power Frame:	Large
Impeller Type:	Cupped
Dynamic. Bal. Impeller:	Two plane
Solid Size:	4"
Pump Material:	Ni-Hard 650
Impeller Material:	Ni-Hard 650
Volute Material:	Ni-Hard 650
Suction Cover:	Ni-Hard 650
Wear Plate:	Ni-Hard 650
Box Type:	Seal box
Bearings:	oil
Pump Shaft:	Steel
Shaft Sleeve:	416 Stainless Steel
Special Coating:	Standard Factory Paint
Motor Manufacturer:	Reliance
Horse Power:	7.5
RPM:	1150
Volts:	460
Phase:	3
Hertz:	60
Motor Type:	Explosion Proof Energy Efficient
Insulation:	Class F

ESSCO PUMPS AND CONTROLS

Pump Data

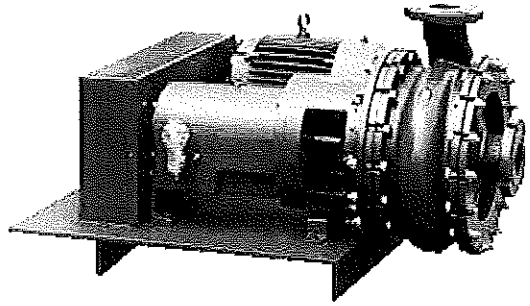
Equipment Manufacturer

ESSCO Pumps and Controls

Job Number 11143

ESSCO

HORIZONTAL RECESSED IMPELLER PUMPS
CUP STYLE IMPELLER
For Waste Water Treatment Plants



Pictured above is an ESSCO 3x14 HDPL belt driven side by side heavy duty horizontal pump with large power frame and recessed cup style impeller.

ESSCO has been designing and manufacturing recessed style cupped impeller horizontal pumps since 1985. ESSCO includes all the features dictated by the needs of our customers in the area of wear and abrasion resistance and has improved on many of these features. ESSCO surveyed their valued customers prior to designing this series of pumps to eliminate the problems they experienced using other manufacturer's products. Customer suggestions were instrumental in the design of this product. After final assembly of the first units customers were invited to the factory to inspect the units. Their additional suggestions were incorporated into the final design the pump, which proved to be a remarkable contribution to a well designed product. ESSCO has always had a policy of listening to our customers and implementing product changes when it makes sense to do so. ESSCO's recessed cup style impeller horizontal pump is designed to handle grit, sludge, rags and long stringy material without plugging. These types of solids are commonly found in waste water treatment plants and other sever duty installations. ***ESSCO offers a prorated 5 YEAR WARRANTY as an option.*** Consult factory for details.

VOLUTE: Each ESSCO back pullout style volute is designed for ease of assembly and maximum life and is manufactured from extremely abrasion resistant materials. Extra material is provided in high wear areas as well as special designs to handle heavy grit slurries and sludges. Due to the Brinnell hardness of the volute all bolting flanges are slotted to allow for ease of assembly. ESSCO has a standard centerline discharge volute which allows it to be self venting and automatically releases air trapped in the pump volute (also known as an air bound pump). Air bound pumps are a common complaint of users who have tangential discharge volutes. The centerline discharge also eliminates the need for a right hand and left hand pump case. An optional conventional tangential design is available upon request.

SUCTION COVER: A contoured suction cover is provided to insure passage of suction sized solids from grit, rags or sludge laden liquids. The suction cover thickness ranges from .75" at the volute bolt flange to a massive 1.5" thickness at the point of highest wear. The generous amount of material provided will

ESSCO Pumps & Controls

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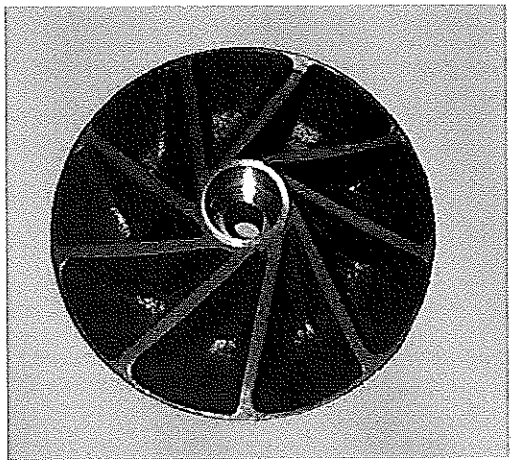
ESSCO

HORIZONTAL RECESSED IMPELLER PUMPS
CUP STYLE IMPELLER
For Waste Water Treatment Plants



The impeller pictured above is from a model 3x14. ESSCO uses a straight machined bore and keyway to allow for the best possible shaft attachment.

provide the owner the maximum possible life of the suction cover which in turn reduces the overall cost of ownership for the life of the unit. The suction flange is slotted for easy connection to suction piping and has a raised face to allow for proper gasket sealing. Suction flange match ANSI 150# dimensions. All gasket surfaces are ground to a smooth finish which allows for the best possible gasket seal. ESSCO eliminated an O-Ring glued to an "as cast" irregular surface groove. This eliminated leakage associated with the O-Ring method of sealing.

IMPELLER: The ESSCO cup style impeller was given thorough design consideration. Utilizing modern methods of manufacturing, ESSCO was able to produce impellers with a straight, accurate bore and keyway. Specification requirements using a tapered shaft with a flat section to act as a keyway, coupled to a soft lead babbitt material in the bore of the impeller, was improved upon with the use of a straight bore design. By using up to date manufacturing practices and methods a major complaint of maintenance personnel was alleviated. Another added design benefit was recessing the impeller bolt area to protect it from grit and debris. The ESSCO impeller bolt is protected from wear. ESSCO included extra thick tapered impeller vanes, deep vane pockets, extra sacrificial material in high wear areas, heavy duty rear impeller shroud and a contoured impeller face which matches the shape of the suction cove. All of these features insure the maximum impeller life.

IMPELLER BOLT PROTECTOR: As an added feature, ESSCO includes an impeller bolt protector on each pump. Even though the impeller bolt is located in a recessed area of the impeller there was a potential for grit to cause wear on the bolt head making it very difficult for removal of the bolt. ESSCO manufactures the bolt protector from the same material as the impeller to completely cover the head of the bolt. This protects the head of the bolt from the pumped material thereby insuring no damage to the impeller bolt.

WEAR PLATE: Located behind the impeller and in front of the stuffing box is a heavy duty wear plate. The wear plate is designed as a single monolithic piece to provide maximum protection to the stuffing box or optional mechanical seal housing. ESSCO does not use

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cast in soft metal inserts on the wear plate. Maintenance personnel complained about constant leaking around the inserts cast into other manufacturers wear plates. The problem was easily solved by simply not using inserts. The ESSCO wear plate is contoured to match the impeller back shroud which reduces the possibility of grit and sludge getting between the wear plate and the impeller shroud causing excess wear.

STUFFING BOX: The stuffing box is a two piece design, consisting of "stuffing box ring" and a "stuffing box cartridge". The stuffing box cartridge is bolted to the stuffing box ring which allows for the two pieces to be manufactured from different materials. ESSCO has supplied many customers with a cast iron stuffing box ring and an optional stainless or bronze stuffing box cartridge. This eliminates many problems associated with corrosion as experienced with standard cast iron stuffing boxes. The standard packing gland is bronze, but is available in an optional stainless or alloy material.

POWER FRAME: ESSCO provides a heavy duty, cast iron, cartridge type power frame. The power frame contains heavy duty bearings which are available for grease or oil lubrication. ESSCO utilizes state of the art bearing designs which are supplied by major bearing manufacturers. A unique feature of ESSCO's pump design is the option of upgrading to a one size larger power frame. A pump with a small power frame can be upgraded to a medium sized power frame and a unit with a medium power frame as standard can be upgraded to a large power frame. This option is popular with owners who wish to keep a minimum of spare parts while spanning multiple pump sizes.

SHAFT AND BEARINGS: ESSCO has designed the shaft and bearing combination around a minimum B10 (L10) life of 100,000 hours. ESSCO furnishes heavy duty pump shafts from the best quality steel standard which have a tensile strength of 150,000 PSI and a yield strength of 130,000 PSI. Each shaft and bearing set provides the maximum life possible. 316 SS shafts are available as an option.

SHAFT SLEEVE: ESSCO offers a wide variety of shaft sleeve materials. Standard shaft sleeves are hardened 400 series stainless steel. Each shaft sleeve has an internal O-ring to seal between the shaft and the sleeve which prevents the pumped liquid from damaging the shaft. The standard shaft sleeve is key driven to insure rotational integrity. Typical options for shaft sleeves are 316 SS, Stellite, Hastaloy along with many others.

PACKING AND MECHANICAL SEALS: ESSCO furnishes graphite impregnated non-asbestos braided packing as a standard. Each packed stuffing box contains (5) five rings of packing and a Teflon lantern ring. The standard packing box can accommodate double mechanical seals as well as cartridge style mechanical seals.

MATERIALS: **(Check desired material)**

___ Nihard 550 Brinnell (Standard Material)
___ Nihard 650 Brinnell
___ Nihard 650-750 Brinnell
___ HCI 550 Brinnell (Alternate Standard Material)
___ HCI 650 Brinnell
___ HCI 650-750 Brinnell

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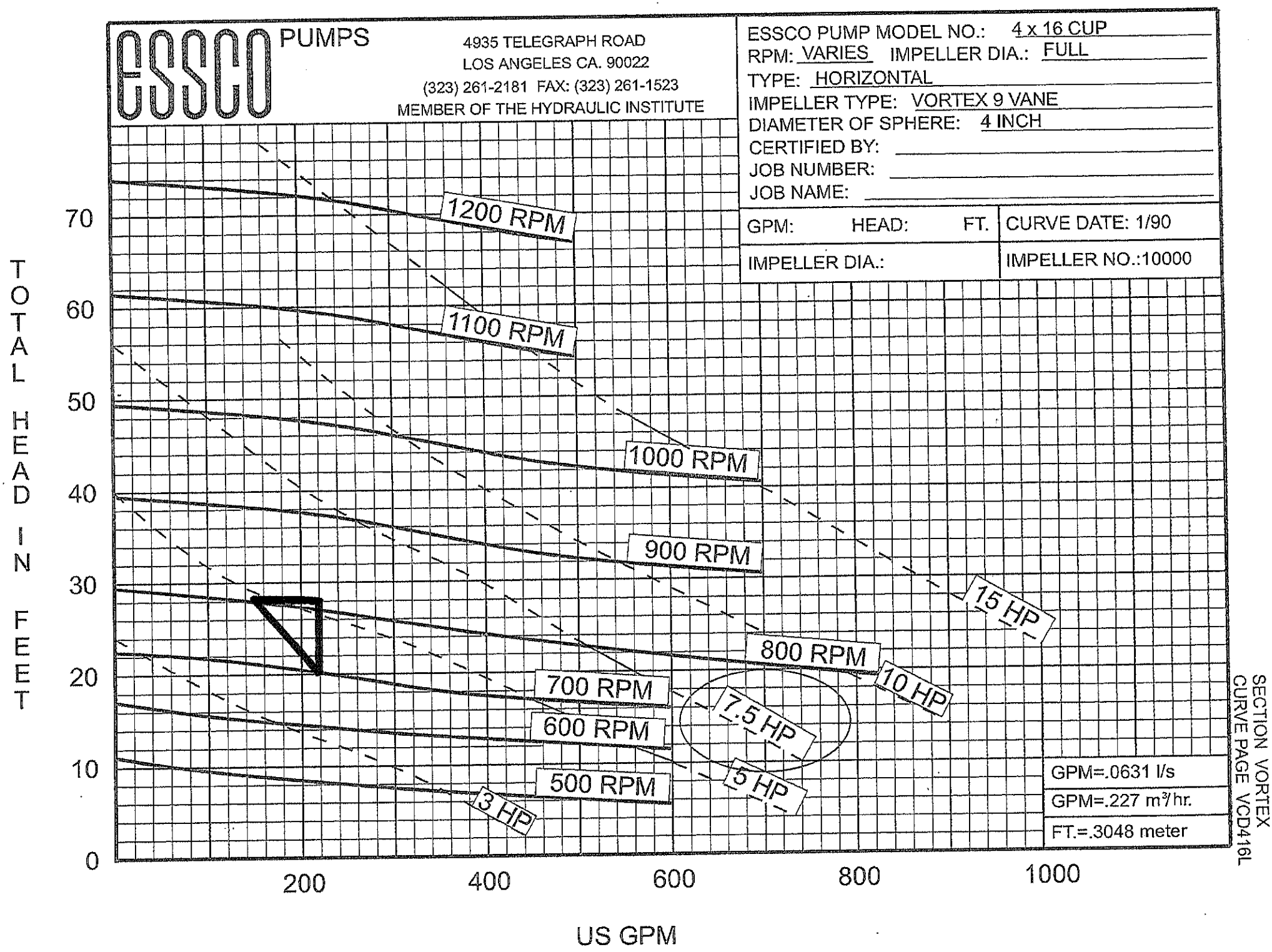
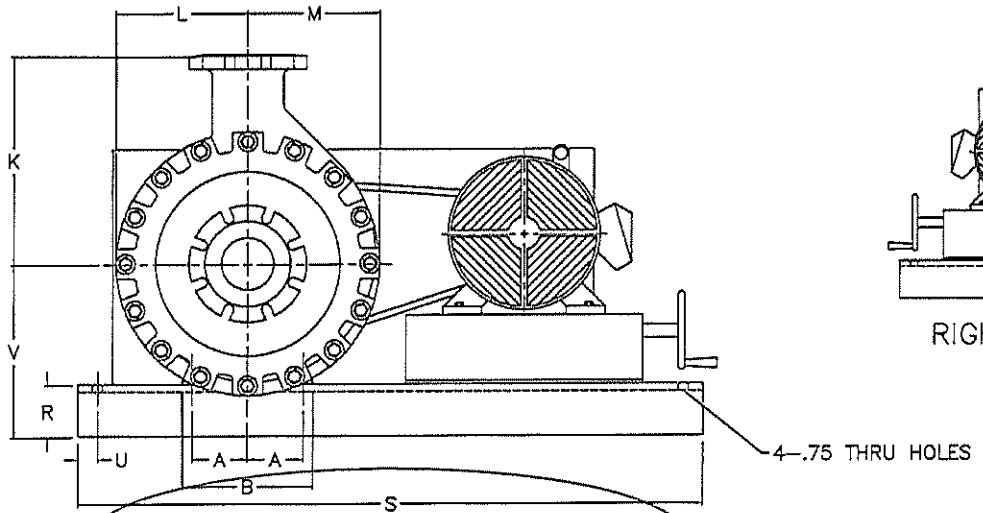

ESSCO PUMPS
4935 TELEGRAPH ROAD
LOS ANGELES CA. 90022
(323) 261-2181 FAX: (323) 261-1523
MEMBER OF THE HYDRAULIC INSTITUTE
ESSCO PUMP MODEL NO.: 4 x 16 CUP
RPM: VARIES IMPELLER DIA.: FULL
TYPE: HORIZONTAL
IMPELLER TYPE: VORTEX 9 VANE
DIAMETER OF SPHERE: 4 INCH
CERTIFIED BY:
JOB NUMBER:
JOB NAME:
GPM: HEAD: FT.
CURVE DATE: 1/90
IMPELLER DIA.:
IMPELLER NO.:10000
1200 RPM
1100 RPM
1000 RPM
900 RPM
800 RPM
700 RPM
600 RPM
500 RPM
15 HP
10 HP
7.5 HP
5 HP
3 HP
TOTAL HEAD IN FEET
0
10
20
30
40
50
60
70
200
400
600
800
1000
US GPM
GPM=.0631 l/s
GPM=.227 m³/hr.
FT.=.3048 meter
SECTION VORTEX
CURVE PAGE VCD416L

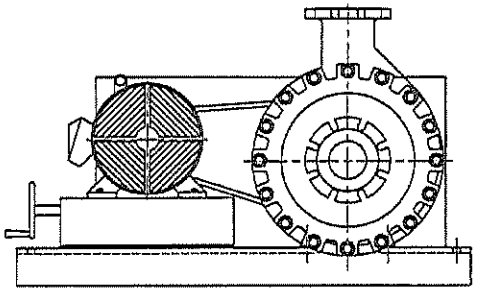
JOB #: _____

SIZE	SUCT(2)	DISCH(2)	A	B	J	K	L	M	N	O	Q	R	S	U	V	X
4x16	4	4	4.25	10	9.25	16.00	10.13	10.13	7.25	8.72	20.75	4	48	1.5	13.25	33.0

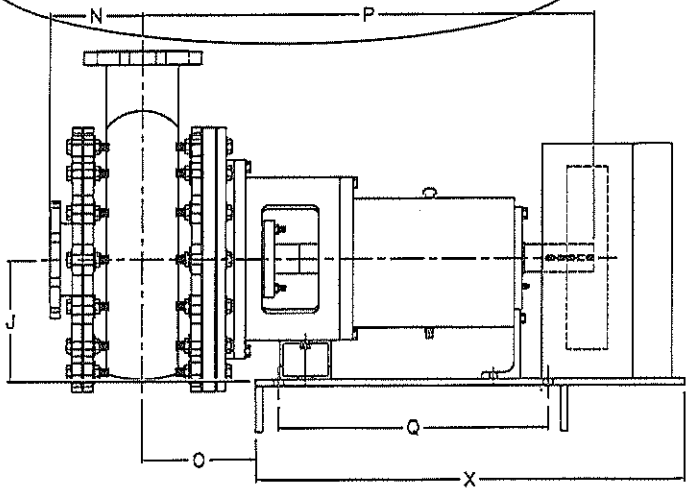
CONSTRUCTION
NiHARD 550
NiHARD 650
HCI 550
HCI 650
OTHER



LEFT HAND ARRANGEMENT



RIGHT HAND ARRANGEMENT



JOB NAME: _____

CERTIFIED BY: _____

DATE: _____

TYPICAL

(2) COMPLIES WITH ANSI STD. FOR FOR 150# DRILLING

(1) WITH WEAR PLATE ADD .75 TO P & O DIMENSIONS

NOTES:

ALL DIMENSIONS ARE IN INCHES

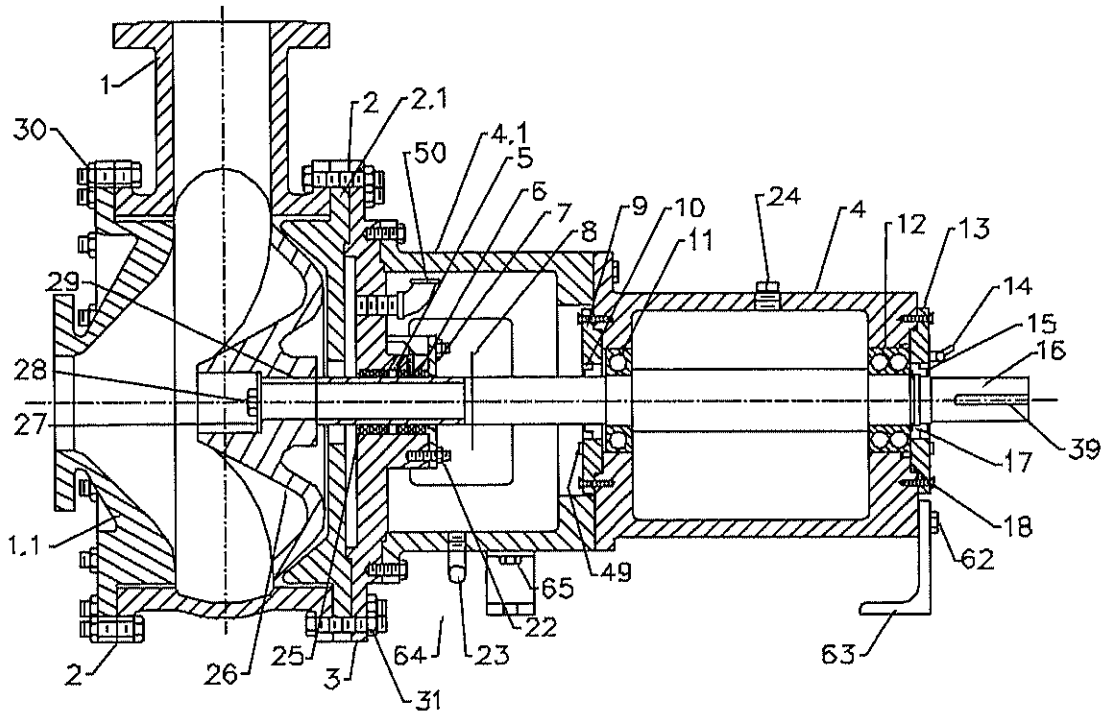
DATE: 9/1/01	ESSCO PUMPS
FILE NAME: HDPLHIB	
DRAWN BY: BRIAN B.	HORIZONTAL DRY PIT
CHECKED BY: J.I.	LARGE POWER FRAME
REVISED BY:	HARD IRON
REV. DATE:	

JOB #:_____

TYPICAL

PARTS LIST		MATERIALS	
NO.	DESCRIPTION	NIHARD	HCI
1	VOLUTE	NIHARD	HCI
1.1	SUCTION COVER	NIHARD	HCI
2	VOLUTE GASKET	NEOPRENE	NEOPRENE
2.1	WEAR PLATE	NIHARD	HCI
3	STUFFING BOX	CAST IRON	CAST IRON
4	POWER FRAME	CAST IRON	CAST IRON
4.1	STUFFING BOX HOUSING	CAST IRON	CAST IRON
5	LANTERN RING	TEFLON	TEFLON
6	PACKING	GRAPHITE	GRAPHITE
7	GLAND	BRONZE	BRONZE
8	SLINGER	PVC	PVC
9	BEARING CAP	CAST IRON	CAST IRON
10	GREASE (3)/OIL SEAL	RUBBER	RUBBER
11	INBOARD BEARING	-----	-----
12	OUTBOARD BEARING	----	----
13	BEARING CAP	CAST IRON	CAST IRON
14	GREASE FITTING (3)	PLATED STEEL	PLATED STEEL
15	GREASE (3)/OIL SEAL	RUBBER	RUBBER
16	SHAFT	etd 150 STEEL	etd 150 STEEL
17	SNAP RING	STEEL	STEEL
18	O-RING	BUNA N	BUNA N
22	STUD, NUT AND WASHER	304 S.S.	304 S.S.
23	DRAIN PLUG	PLATED STEEL	PLATED STEEL
24	PIPE PLUG/AIR VENT	PLATED STEEL	PLATED STEEL
25	SHAFT SLEEVE	S.S. SEE NOTE (1)	S.S. SEE NOTE (1)
26	IMPELLER	NIHARD	HCI
27	IMPELLER WASHER	304 S.S.	304 S.S.
28	IMPELLER BOLT	304 S.S.	304 S.S.
29	IMPELLER KEY	304 S.S.	304 S.S.
30	STAND/SUCTION COVER BOLT	304 S.S.	304 S.S.
31	VOLUTE BOLT	304 S.S.	304 S.S.
39	COUPLING END KEY	304 S.S.	304 S.S.
49	GREASE RELIEF FITTING (3)	PLATED STEEL	PLATED STEEL
50	VENT	GAL. MAL. IRON	GAL. MAL. IRON
62	OUTBOARD LEG BOLT	304 S.S.	304 S.S.
63	OUTBOARD LEG	STEEL	STEEL
64	INBOARD LEG	STEEL	STEEL
65	INBOARD LEG BOLT	304 S.S.	304 S.S.

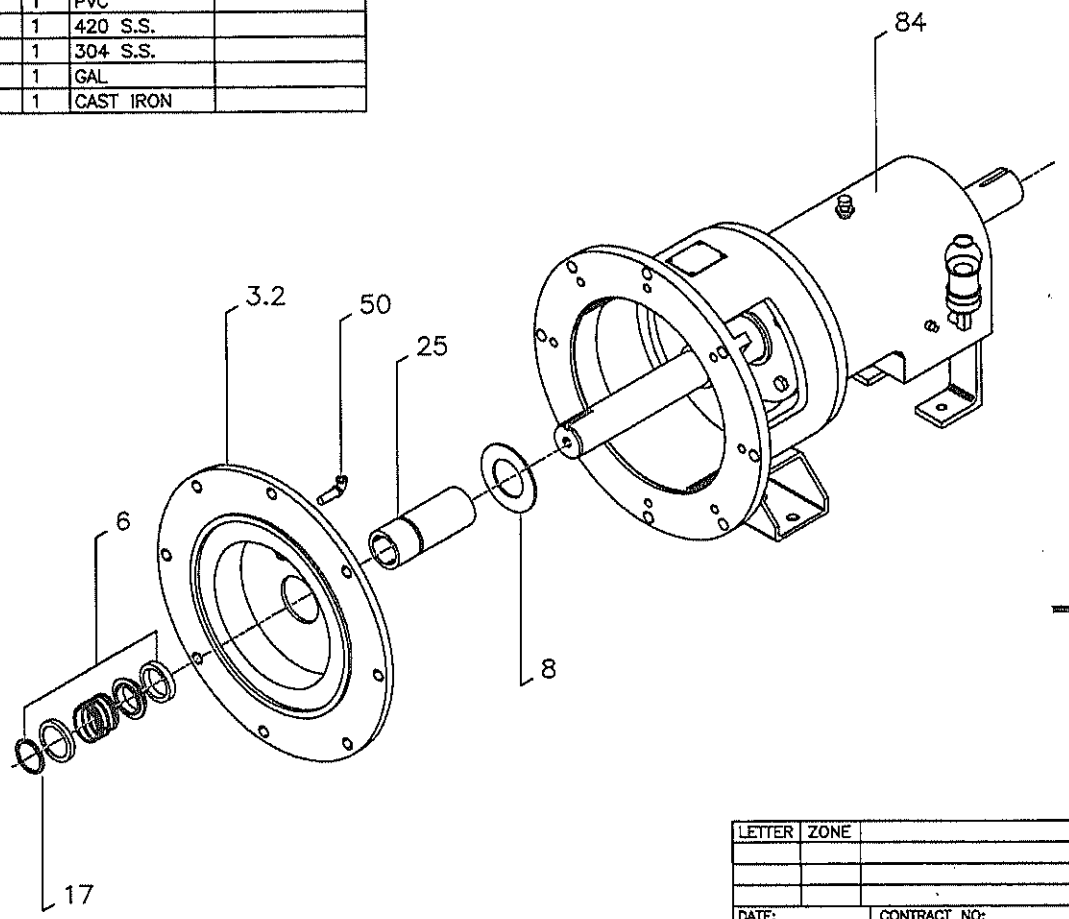
BRINELL HARDNESS SCHEDULE
550 BRN
650 BRN
700 BRN



(1) HARDENED TO 450 BRN. MINIMUM.
(2) ALL FASTENERS ARE 304 OR 316 S.S.
(3) USE ON GREASE LUBE PUMPS ONLY.
NOTES:

DATE: 12/20/88	ESSCO PUMPS
FILE NAME: HDPLX	
DRAWN BY: J.I.	
CHECKED BY: J.I.	HORIZONTAL LARGE POWER FRAME HARD IRON CONSTRUCTION CUP STYLE IMPELLER
REV. BY: K PADGETT	
REV. DATE: 8/23/93	

PARTS LIST			MATERIAL	OPTIONS
NO.	DESCRIPTION	QTY	CAST IRON	
3.2	SEAL PLATE	1	CAST IRON	
6	MECHANICAL SEAL	1	----------	
8	SLINGER	1	PVC	
17	SNAP RING	1	420 S.S.	
25	SHAFT SLEEVE	1	304 S.S.	
50	VENT	1	GAL	
84	HDPL ASSEMBLY	1	CAST IRON	



TYPICAL

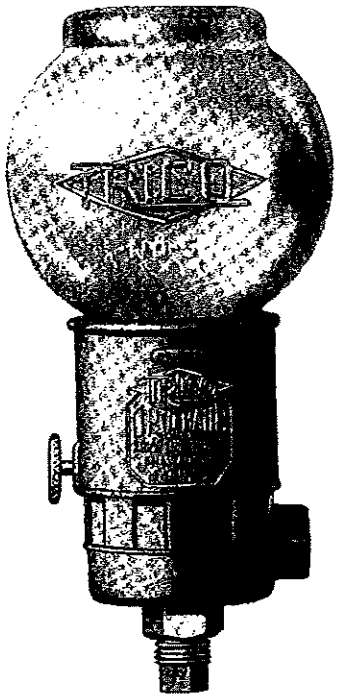
LETTER	ZONE	REVISIONS	REV. DATE:

DATE: 1/21/98	CONTRACT NO:	ESSCO PUMPS
FILE NAME: AHDPLC	CONTRACTORS:	
DRAWN BY: K PADGETT	ARTICLE NUMBER:	OIL LUBED LARGE POWER FRAME ASSEMBLY WITH SINGLE MECHANICAL SEAL BOX PARTS LIST
CHECKED BY: J.I.		

JOB #:_____

GLASS BOTTLE OPTO-MATIC CONSTANT LEVEL OILER

TRICO glass Opto-Matic constant level oilers have been used in every major industry and have proven their value for over forty years. Some of the reasons for their popularity are the exclusive engineering features not found in the other competitive types. When choosing a constant level oiler, the following features should be considered:



ONE PIECE GLASS RESERVOIR

The Opto-Matic oiler permits visual inspection of the oil at any time for proper level and condition of the oil. The one piece glass reservoir eliminates the danger of air entering the lubricator bottle through leaky gaskets on the reservoir bottle. This exclusive TRICO feature prevents leakage of oil from the reservoir, flooding the bearing and rendering the lubricator useless.

AIR VENT SLOTS

These air vents permit air to enter the lubricator for proper functioning at all times. On TRICO Opto-Matic oilers, there are eight air vents spaced equally 360° around the lubricator. The chances of all of these air vents becoming clogged are almost impossible when compared to a single hole which can become clogged very easily and render the lubricator useless. The air intake of the lubricator is designed in such a way that air travels from the bottom of the lubricator upward around the body and over the top. The upper reservoir acts as a baffle to protect the incoming air from atmospheric contaminates in the immediate area.

OIL LEVEL ADJUSTER MECHANISM

This unique device instantly and accurately raises or lowers the oil level in the bearing chamber or gear box. This is simply accomplished by moving the threaded arms up or down the leveling stem until the desired level is maintained. The leveling arms are then locked tight and maintain that setting. This is far simpler than taking a hack saw and cutting off a spout that eventually may end up too short or too long. It also allows the machine builder, who produces several different machines with different oil levels, to stock only one unit instead of several units for different oil levels. On special request, TRICO can suggest ways of making these lubricators tamper proof.

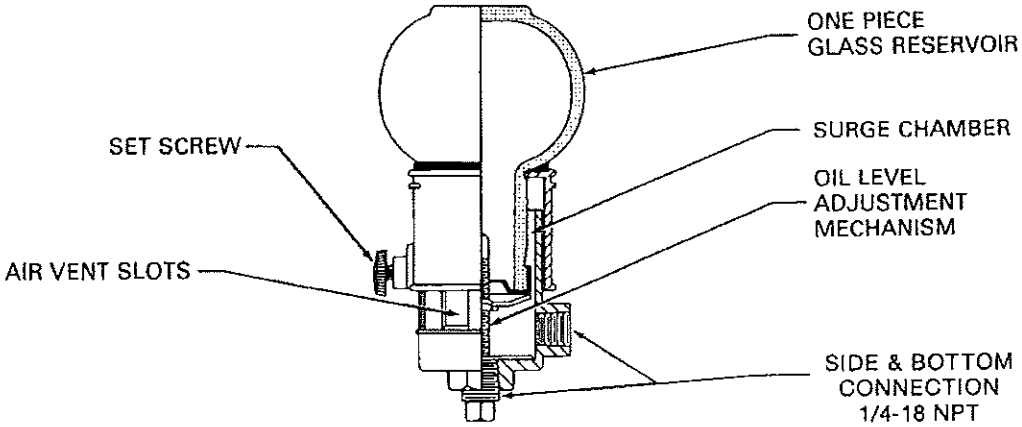
LARGE SURGE CHAMBER

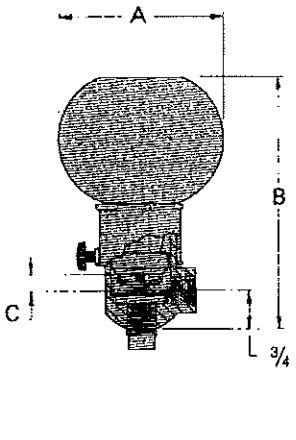
The surge capacity of the TRICO constant level oiler is very important inasmuch as oil adheres to mechanisms in motion as well as to gear box wall, bearing walls, etc. For large bearings, great quantities of oil may be needed to establish an operating oil level. When some machines shut down, there is a new level of oil established above the running level. As this surge of oil goes back to the lubricator, it must have adequate room in the lower reservoir to temporarily store the lubricant. Should this room not be adequate, it would result in oil overflowing the lower casting with excess oil ending up on the floor, causing both a messy condition as well as a safety hazard. Competitive models do not have this outstanding TRICO feature.

SIDE AND BOTTOM CONNECTIONS

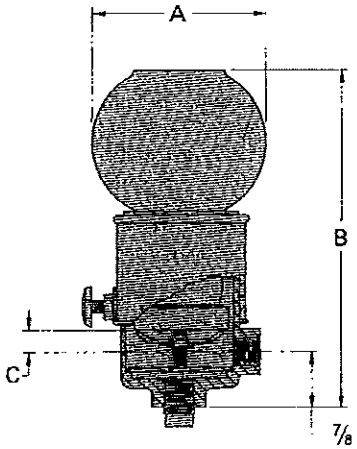
TRICO glass Opto-Matic oilers come with both side and bottom outlets at no additional cost. This allows you to choose the method that best suits your particular installation. And you only need to select one type of lubricator instead of several types.

CONSTRUCTION FEATURES





No. 30001 and 30002
Glass Opto-Matic



No. 30003, 30005, and
30010 Glass Opto-Matic

Material Specifications

Max. Operating Temp. ... 250°F Continuous
Reservoir ..... One Piece Glass Bottle (No Gaskets)
Materials ..... Steel
Castings ..... Zinc Die Cast
Finish ..... Bright Zinc Plated

CAP.	PIPE THREAD CONN.	DIMENSIONS A	B MIN.	B MAX.	C MIN.	C MAX.	CAT. NO.
1¼ OZ.	¼	1 5/16	3⅜	3 11/16	1/32	5/16	30001
2½ OZ.	¼	2½	3 15/16	4¼	1/32	5/16	30002
4 OZ.	¼	2 11/16	5	5¾	5/32	1	30003
8 OZ.	¼	3 3/16	5 15/16	6 11/16	5/32	1	30005
16 OZ.	¼	4⅛	6 13/16	7 5/16	5/32	1	30010

All dimensions shown are in inches.

ACCESSORIES

BREATHER TUBES

ITEM	DESCRIPTION		CAT. NO.
	TYPE "C"	⅛" NPT THREAD	30014
		WICK AIR FILTER	
	TYPE "E"	⅛" NPT THREAD	30015
		DUST CAP	

Accessory Item: Breather tubes are accessories used in conjunction with the Glass Optomatic Oilers to help eliminate vacuums created by abnormally tight bearings or pressures created by high speed bearings. The breather tube helps maintain a constant atmospheric pressure in the bearing housing.

WIRE GUARDS

ITEM	DESCRIPTION	CAT. NO.
	1¼ OZ. OILER WIRE GUARD	30011
	2½ OZ. OILER WIRE GUARD	30012
	4 OZ. OILER WIRE GUARD	30013
	8 OZ. OILER WIRE GUARD	30016
	16 OZ. OILER WIRE GUARD	30020

HOW TO ORDER GLASS OPTO-MATIC OILERS

1. **Specify Quantity** ——— **(2) 30003**
2. **Specify Catalog Number** ———

ESSCO PUMPS AND CONTROLS

Motor Data

Equipment Manufacturer

ESSCO Pumps and Controls

Job Number 11143

BALDOR®

A MEMBER OF THE ABB GROUP

BALDOR® • RELIANCE

Product Information Packet

EM7048T-I

7.5//5HP,1180//980RPM,3PH,60//50HZ,254T

Part Detail							
Revision:	A	Status:	PRD/A	Change #:		Proprietary:	No
Type:	AC	Prod. Type:	0950M	Elec. Spec:	09WGZ590	CD Diagram:	
Enclosure:	XPFC	Mfg Plant:		Mech. Spec:	09F369	Layout:	
Frame:	254T	Mounting:	F1	Poles:	06	Created Date:	06-15-2010
Base:	RG	Rotation:	R	Insulation:	F	Eff. Date:	07-13-2010
Leads:	9#12	Literature:		Elec. Diagram:		Replaced By:	

Nameplate NP0977XP							
NO.		TEMP CODE	T3C				
SPEC.	09F369Z590G1	DE BRG	6309				
CAT.NO.	EM7048T-I	ODE BRG	6208				
HP	7.5//5	GREASE	POLYREX EM				
VOLTS	230/460//190/380	MOTOR WEIGHT	355				
AMPS	21.4/10.7//18.8/9.4	NEMA-NOM-EFF	91				
RPM	1180//980	FL PF	70				
CYCLE	60//50	PH	3	CL	F	FRAME	254T
SER.F.	1.15	DES	B	CODE	J	CC	010A
SER.							
RATING	40C AMB-CONT						
USABLE AT 208V	22.6						

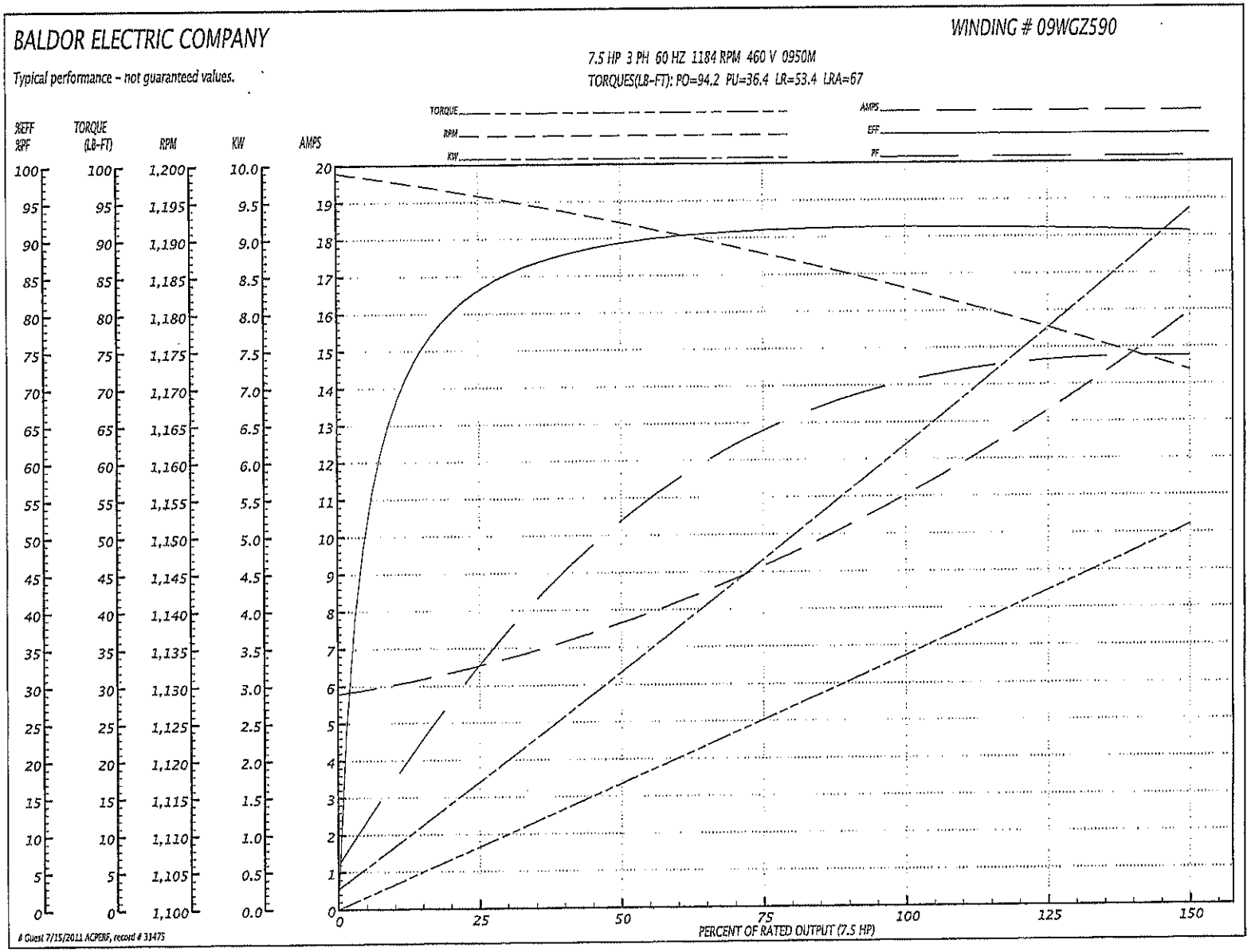
Parts List

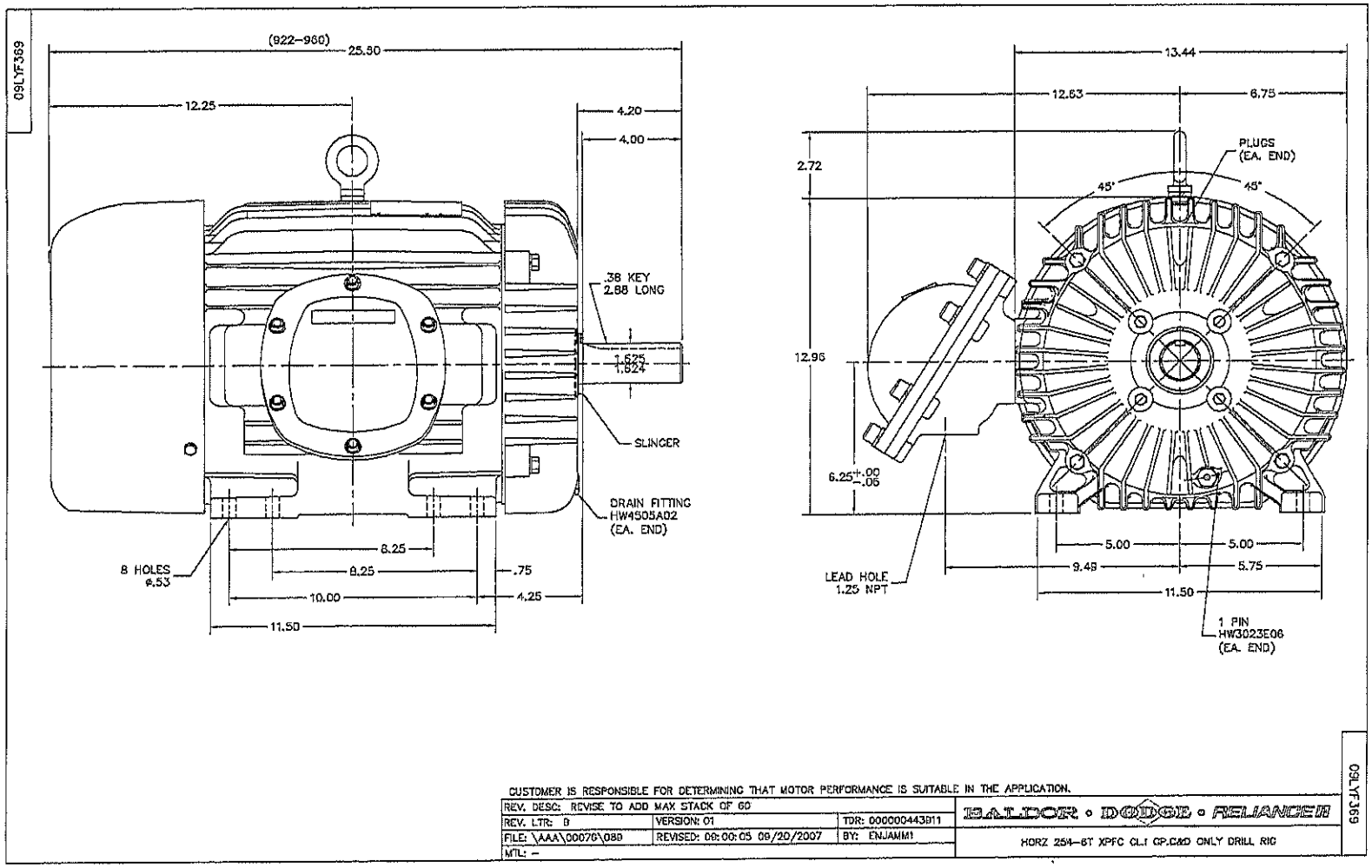
Part Number	Description	Quantity
SA198391	SA 09F369Z590G1	1.000 EA
RA185759	RA 09F369Z590G1	1.000 EA
MJ5000A01	SEALANT, CHICO A COMPOUND	0.050 LB
09CB1003A01	CONDUIT BOX MACH. GROUP C MTRS	1.000 EA
10XN3118K24	5/16-18 X 1.50" HEX HD, GRADE 5	4.000 EA
HW1001A31	LOCKWASHER 5/16, ZINC PLT.591 OD, .319 I	4.000 EA
WD1000B25	BURNDY TERMINAL L125HP	1.000 EA
10XN3118K12	5/16-18 X .75 GRADE 5, ZINC PLATED	1.000 EA
HW1001A31	LOCKWASHER 5/16, ZINC PLT.591 OD, .319 I	1.000 EA
09EP1700A33P	FR ENDPLATE, MACH, XPFC W/DRN HW4505A02	1.000 EA
HW3023E06	.125 X .625 SPIRAL SPRING PIN	1.000 EA
10XN3816K28	3/8-16 X 1.75 HEX HD CAP SCREW, GRADE 5	4.000 EA
HW1001A38	LOCKWASHER 3/8, ZINC PLT .688 OD, .382 I	4.000 EA
HW5100A08	W3118-035 WVY WSHR (WB)	1.000 EA
10XN2520K36	1/4-20 X 2.25" HX HD SCRWGRADE 5, ZINC P	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
09EP1707A16P	PU E.P., MACH. W/DRAIN HW4505A02 W/PRIME	1.000 EA
HW3023E06	.125 X .625 SPIRAL SPRING PIN	1.000 EA
10XN3816K28	3/8-16 X 1.75 HEX HD CAP SCREW, GRADE 5	4.000 EA
HW1001A38	LOCKWASHER 3/8, ZINC PLT .688 OD, .382 I	4.000 EA
09FH1004A03	FAN COVER, MACH	1.000 EA
10XN2520K12	1/4-20 X.75 GRD 5	3.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	3.000 EA
HA2066A01	SLINGER, ALUM (AUTO)	1.000 EA

Parts List (continued)

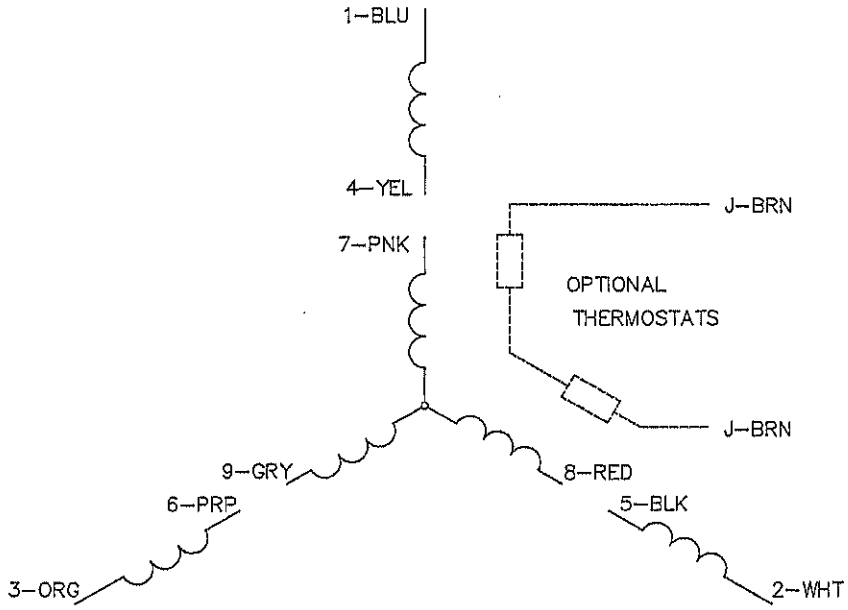
Part Number	Description	Quantity
80XN1032A07	SET SCREW, HEX XOCK, ZN	1.000 EA
09CB1502A01	CONDUIT BOX LID MACH. GROUP C MTRS	1.000 EA
84XN5013J24	1/2-13 X 1-1/2 HEX SOCKET HD CAP SCREW	6.000 EA
HW1001A50	LOCKWASHER 1/2, ZINC PLT,.879 OD, .509 I	6.000 EA
HW2501G25	KEY, 3/8 SQ X 2.875	1.000 EA
LB1115	LABEL,LIFTING DEVICE	1.000 EA
HW4500A20	1/8NPT SL PIPE PLUG	2.000 EA
HW4505A02	BREATHER/DRAIN-EXP PROOF-.250-18 PTF AIS	1.000 EA
MJ1000A75	GREASE, POLYREX EM EXXON	0.080 LB
HW4500A20	1/8NPT SL PIPE PLUG	2.000 EA
HW4505A02	BREATHER/DRAIN-EXP PROOF-.250-18 PTF AIS	1.000 EA
09FN3001A01SP	EXTERNAL FAN, PLASTIC	1.000 EA
HW2500A25	WOODRUFF KEY USA #1008 #BLOW CARBON STEE	1.000 EA
51XB1214A20	12-14X1.25 HXWSSLD SERTYB	1.000 EA
MG1025G05	PAINT 789.201 (WILCO) DARK GRAY METALLIC	0.050 GA
85XU0407A04	#4-7 X 1/4 DRIVE PIN	6.000 EA
LB1081	LABEL CSA XPROOF	1.000 EA
LB5040	INSTRUCTION TAG, AC & DC	1.000 EA
LB1119	WARNING LABEL	1.000 EA
LB1125C02	SUPER-E (STOCK CTN LABEL SUPER-E WITH FL	4.000 EA
LB1357	ENERGY GUIDE LABEL (BOX LABEL)	1.000 SH
LC0145B01	CONNECTION LABEL	1.000 EA
NP0977XP	UL/CSA, CLI GP-C&D,CC	1.000 EA
40PA1005	PACKAGING GROUP, 09 STD	1.000 EA

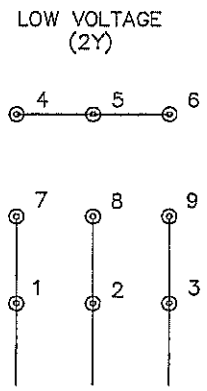
Performance Graph at 460V, 60Hz, 7.5HP Typical performance - Not guaranteed values

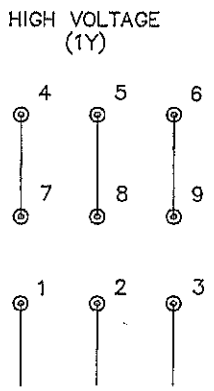



09LYF369
(922-960)
25.50
12.25
4.20
4.00
.38 KEY
2.88 LONG
1.625
1.624
SLINGER
DRAIN FITTING
HW4505A02
(EA. END)
8 HOLES
Ø.53
8.25
8.25
.75
10.00
4.25
11.50
13.44
12.63
6.75
PLUGS
(EA. END)
2.72
45°
45°
12.96
6.25 +.00 -.06
5.00
5.00
9.48
5.75
11.50
LEAD HOLE
1.25 NPT
1 PIN
HW3023E06
(EA. END)
CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT MOTOR PERFORMANCE IS SUITABLE IN THE APPLICATION.
REV. DESC: REVISE TO ADD MAX STACK OF 60
REV. LTR: B
VERSION: 01
TDR: 000000443911
FILE: \AAA\00076\089
REVISED: 08:00:05 09/20/2007
BY: ENJAMM1
MTL: –
BALDOR • DODGE • RELIANCE
HORZ 254-6T XPFC CL.1 GP.CMD ONLY DRILL RIG
09LYF369

CD0005







NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435
CD0005		FILE: AAA00005140	MDL: –
		MTL: –	

BALDOR ELECTRIC Co.

3PH, DV, 9 LEADS

CD0005

Test Date: 3/21/2012

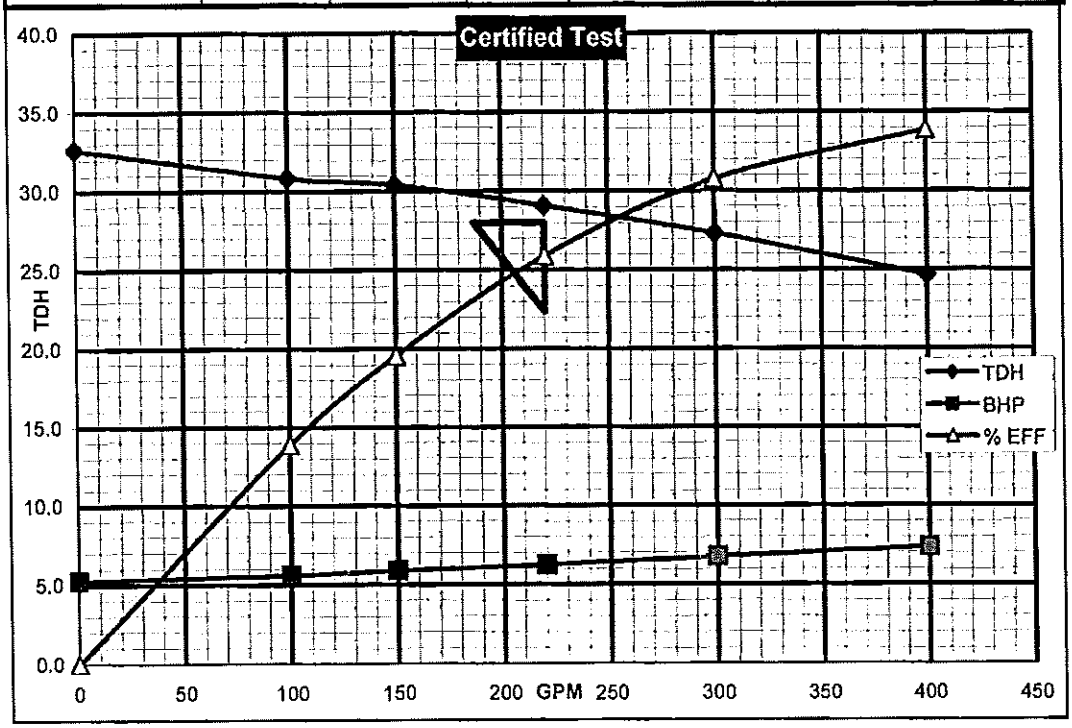
ESSCO Pumps

Member of Hydraulic Institute

Pump Model: 4x16				Pump Type: HDPL		
GPM	TDH	Tested By:		Pump Serial #: 11143-1		
220	28	Audel		Volute Style: Centerline Discharge		
Pump RPM	770			Test Number: 8522		
Motor Info:	BHP	RPM	FLA	Test Voltage/Phase	TRIM	Vanes
	7.5	1150	10.7	460	16.00	7

Reading No.	1	2	3	4	5	6
GPM	400	300	220	150	100	0
PSI	10.1	11.3	12.1	12.7	12.9	13.7
Feet	23.33	26.10	27.95	29.34	29.80	31.65
Water to CL of Gage	1.00	1.00	1.00	1.00	1.00	1.00
Hf Header	0.28	0.17	0.09	0.05	0.02	0.00
Vel Head	0.07	0.05	0.04	0.03	0.02	0.00
TDH	24.68	27.32	29.08	30.41	30.84	32.65
Volts	456	457	457	457	457	459
Amps	10.5	9.6	8.9	8.4	8.0	7.5
KW Reading	5.6	4.9	4.2	4.1	3.7	3
Power Factor	0.208	0.167	0.147	0.138	0.135	0.105

GPM	0	100	150	220	300	400
TDH	32.6	30.8	30.4	29.1	27.3	24.7
BHP	5.26	5.61	5.89	6.24	6.73	7.36
% EFF	0	14	20	26	31	34
	+					



Witnessed By: Date:

Certified By: Date: 3/22/12

Test Date: 3/22/2012

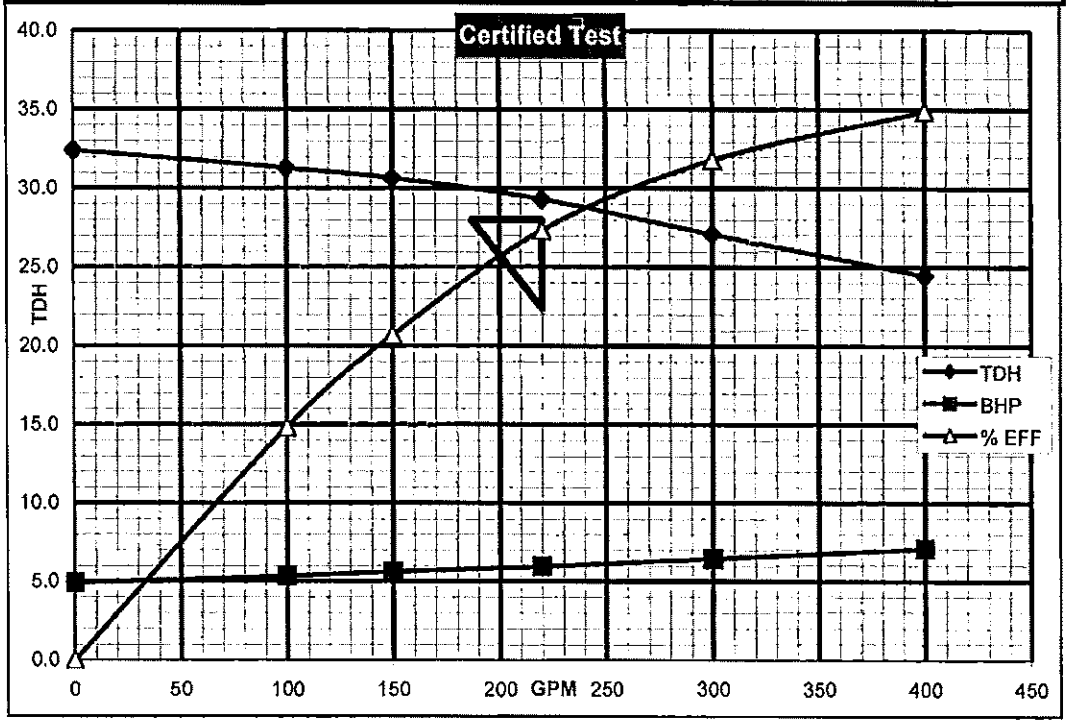
ESSCO Pumps

Member of Hydraulic Institute

Pump Model: 4x16				Pump Type: HDPL		
GPM	TDH	Tested By:		Pump Serial #: 11143-2		
220	28	Audel		Volute Style: Centerline Discharge		
Pump RPM	770			Test Number: 8523		
Motor Info:	BHP	RPM	FLA	Test Voltage/Phase	TRIM	Vanes
	7.5	1150	10.7	460	16.00	7

Reading No.	1	2	3	4	5	6
GPM	400	300	220	150	100	0
PSI	10	11.2	12.2	12.8	13.1	13.6
Feet	23.10	25.87	28.18	29.57	30.26	31.42
Water to CL of Gage	1.00	1.00	1.00	1.00	1.00	1.00
Hf Header	0.28	0.17	0.09	0.05	0.02	0.00
Vel Head	0.07	0.05	0.04	0.03	0.02	0.00
TDH	24.45	27.09	29.31	30.64	31.30	32.42
Volts	452	455	455	455	455	460
Amps	10.1	9.2	8.5	8.0	7.6	7.0
KW Reading	5.5	4.6	4.5	3.6	3.4	2.8
Power Factor	0.196	0.156	0.144	0.115	0.105	0.084

GPM	0	100	150	220	300	400
TDH	32.4	31.3	30.6	29.3	27.1	24.5
BHP	4.91	5.33	5.61	5.96	6.45	7.08
% EFF	0	15	21	27	32	35
	+					



Witnessed By:	Date:
Certified By:	Date: 3/22/12

ESSCO

INSTALLATION,
OPERATION AND
MAINTENANCE
INSTRUCTIONS

THIS MANUAL APPLIES TO:

DRY PIT VORTEX PUMPS
VERTICAL VDPS, VDPM, VDPL, XLVDP
HORIZONTAL HDPS, HDPM, HDPL, XLHDP
CLOSE COUPLED VDPCC, HDPCC

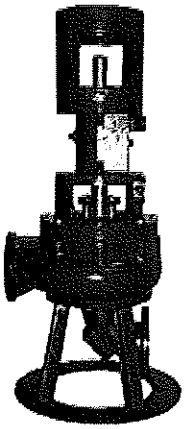
CAUTION

CAREFULLY READ ALL SECTIONS IN THIS MANUAL AND ALL OTHER INSTRUCTION MANUALS PROVIDED BY MANUFACTURERS OF OTHER EQUIPMENT SUPPLIED WITH THIS PUMP

CAUTION

PRIOR TO WORKING ON ANY ELECTRICAL OR PUMP EQUIPMENT, SAFETY ELECTRICAL LOCKOUT CIRCUITS SHOULD BE INSTALLED AND LOCKED OUT TO PREVENT SERIOUS INJURY OR DEATH. REVIEW ALL LOCAL, STATE, FEDERAL CODES AND OSHA REQUIREMENTS BEFORE WORKING ON ANY PUMPING EQUIPMENT.

SAFETY IS YOUR RESPONSIBILITY



ESSCO PUMP DIVISION
ENGINEERS SALES-SERVICE CO., INC.
4935 TELEGRAPH RD.
LOS ANGELES, CA. 90022
Tel. (323) 261-2181 Fax. (323) 261-1523

www.esscopumps.com

Table of Contents

Table of Contents Continued

PUMP IDENTIFICATION

Congratulations! You are the owner of the very best vortex dry pit pump commercially available. With proper care and maintenance it will provide you with reliable service for many years.

ESSCO pumps are of the heavy duty design with 100% recessed vortex impellers. **ESSCO** offers a wide variety of impeller designs to allow for equipment flexibility. **ESSCO** pumps are ideally suited for applications such as sewage, grit (heavy and/or fine), slurry, food waste handling, food handling and a variety of other services. Standard construction is cast iron with a packed stuffing box. Standard optional materials are available such as 316 S.S. (CF8M), High Chromium Iron, Nihard, CD4MCu, Bronze, and many others. Not all pump models are available in all materials. **ESSCO** pumps are engineered to accept a wide variety of mechanical seal materials.

This manual applies to:

All sizes of 100% Recessed Vortex Dry Pit pumps.

4x12* VDPM	
4x12	Pump size- 4" suction and discharge, 12" max. diameter impeller passing 4" solids.
6x4x12	Pump size– 6" suction, 4" discharge, 12" max. diameter impeller passing 4" solids
-*	ESSCO vortex pumps will pass solids equal to the discharge diameter.
V or H	Vertical or Horizontal
DP	Dry Pit
S,M, L or XL	Power Frame Size– Small, Medium, Large or Extra Large

In some cases a vortex pump model will be preceded by the suction size such as 8x6x17-100-6.

(1) **ESSCO** vortex pumps will pass solids equal to the discharge diameter.

CAUTION NOTES

These instructions apply to the pump only and are intended to be general and not specific. If the operating conditions change, refer to the factory or local factory representative or distributor for reapplication. Always refer to the manuals provided by manufacturers of the other equipment for their separate instructions and maintenance schedules.

CAUTION
IMPORTANT SAFETY NOTICE

The installation, use and operation of this type of equipment is affected by various federal, state and local laws and the regulations concerning OSHA. Compliance with such laws relating to the proper installation, safe operation and maintenance of this type of equipment is the responsibility of the equipment owner and all necessary steps should be taken by the owner to assure compliance with such laws prior to operation and after performing equipment maintenance.

STORAGE OF PUMPS

If the equipment is not to be immediately installed and operated, store it in a clean, dry, well ventilated place, free from vibrations, moisture, rapid and wide variations in temperature.

A UNIT IS IN STORAGE WHEN:

1. It has been delivered to the jobsite and is awaiting installation.
2. It has been installed but operation is delayed pending completion of construction.
3. There are long periods (30 days or more) between operation cycles.
4. The pump is shut down for periods of longer than 30 days.

NOTE: Storage requirements vary depending on the length of storage, the climatic environment and the equipment. For storage periods of three months or longer, contact the manufacturer for specific instructions. Improper storage could damage the equipment

which would result in non-warranty covered restoration or non-warranty covered product failures.

DOUBLE MECHANICAL SEAL PUMPS

Pour at least 4 ounces of mineral oil into the seal housing and drain the oil just prior to start up of pump. BE SURE TO CHECK FOR COMPATIBILITY OF THE MINERAL OIL AND THE MECHANICAL SEAL ELASTOMERS.

SPECIAL INSTRUCTIONS WHILE PUMPS ARE IN STORAGE

Rotate the shaft for several revolutions at least once every week to:

1. Coat the bearing with lubricant
2. Retard oxidation or corrosion and
3. Prevent possible false brinelling

INTRODUCTION

This manual contains information which is the result of engineering research and experience. It is designed to supply instructions for the installation, operation and maintenance of your pump. Failure or neglect to properly install, operate or maintain your pump may result in personal injury, property damage or unnecessary damage to the equipment.

Variations exist in both the equipment used with these pumps and in the particular installation of the pump and motor. Specific operating instructions are not within the scope of this manual. The manual contains general rules for installation, operation and maintenance of the pump. **Observe and heed all caution or danger tags attached to the equipment or included in this booklet.**

INSTALLATION DRY PIT PUMPS

UNPACKING AND INSPECTION

Upon receipt, carefully unpack and inspect the pump and driver assemblies and individual parts to insure none are missing or damaged. Inspect all boxes and packing material for loose parts before discarding and report immediately to the factory involved, any missing parts or damage incurred during shipment. ***You*** must file a "damaged or lost in shipment" claim with the carrier immediately.

Horizontal pump and assemblies mounted on a structural steel base are aligned at the factory. However, alignment may change in transit or during installation. It must be checked after the unit is leveled on the foundation, after the grouting has set and the foundation bolts are tightened, and after piping is completed.

Tapped mounting blocks are furnished with horizontal pumps when the motor is to be field mounted. After the alignment of the motor is completed, the mounting blocks must be welded to the base and the alignment rechecked.

The installation of a vertical pump is essentially the same as for the horizontal configuration. Foundation, piping and alignment adjustments are accomplished using the same technique.

DRY PIT PUMP VENT

ESSCO Dry Pit pumps are shipped with a vent elbow, short nipple and pipe plug. Remove the pipe plug and the pump vent is ready for field installation. *It is recommended that the pumpage from the vent valve be piped back to the wet well above the high water level.*

MINIMUM SUBMERGENCE OF PUMP SUCTION AND PIT DESIGN

Generally it is required that an evenly distributed flow of non-aerated water be supplied to the pump suction. Improper pit design or insufficient suction submergence can result in intake vortexing which reduces the pump's performance and can result in severe damage to the pump.

We recommend that you secure the advice of a qualified Consulting Engineer for the analysis and design of the suction pit. Significant engineering data on pit design is provided in the Hydraulic Institute Standards.

Upon request, **ESSCO** will review plans and give general comments on the installation, but will not approve such plans for a specific installation and will accept no responsibility or liability for the performance of the pump intake structure.

LOCATION AND HANDLING

The pump should be installed as near the fluid as possible. A short direct suction pipe must be used to keep suction losses at a minimum. Locate the pump so the fluid will flow to the suction opening by gravity. The discharge piping should be direct and with as few elbows and fittings as possible.

The pump and motor should be located in an area that will permit periodic inspection and maintenance. Head room and access should be provided and all units should be installed in a dry location with adequate drainage.

WARNING

DO NOT PICK UP THE COMPLETE UNIT BY THE DRIVER, PUMP SHAFTS OR EYE BOLTS.

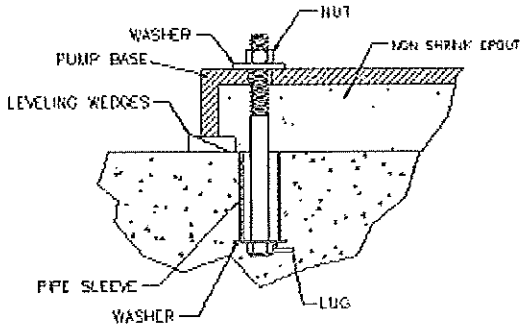
To lift a horizontal mounted unit, a chain or suitable lifting device should be attached to each corner of the base structure. Vertical mounted units may be lifted by using a sling through the motor high ring base, or by the eye bolts when provided in the pump casing. The individual driver may be lifted using the proper eye bolts provided by the manufacturer, but these should not be used to lift the assembled unit.

INSTALLATION WHEN PUMPS ARE FURNISHED WITH A BOLT DOWN STAND OR VERTICAL PUMP STAND

FOUNDATION FOR PUMP STANDS

The foundation should have a level surface and be of sufficient mass to prevent vibration and form a permanent rigid support for the unit. The most satisfactory foundations are concrete with anchor bolts of adequate size embedded in the foundation in pipe sleeves with an inside diameter 2-1/2 times larger than the bolt diameter. This will allow for final accurate positioning of the unit.

Recommended anchor bolt design is shown below.



LEVELING OF THE PUMP UNIT

Lower the pump onto the foundation, positioning the pump so the anchor bolts are aligned in the middle of the holes.

Set the pump on metal shims or metal wedges placed directly under the part of the stand carrying the greatest weight, and spaced close enough to give uniform support and stability.

Adjust the metal shims or wedges until the discharge flange of the submersible pump is **level and plumb.** Make sure that all shims or wedges fit firmly between the foundation and the stand.

If leveling nuts are installed on the anchor bolts and are used for alignment, follow the same procedure as with shims or wedges. Support the pump with additional shims or wedges if necessary. Make sure that all nuts and shims are in firm contact with the stand. Tighten the foundation bolts snugly, but not too firmly, and recheck for alignment before grouting.

CAUTION

THE PUMP AND THE MOTOR MOUNTING SURFACES ARE PARELLEL WHEN MANUFACTURED, AND THE PUMPS AND MOTORS ARE ALLIGNED AT THE FACTORY BEFORE SHIPMENT. DO NOT DISTORT THE BASE BY APPLYING UNDUE FORCE DURING THE ALIGNMENT PROCESS.

CAUTION

DO NOT OVER-TIGHTEN ANCHOR BOLTS OR THE STAND MAY BE DISTORTED.

GROUTING

When the alignment is correct, the unit should be grouted using a high grade non-shrinking grout.

Do not fill the pipe sleeves with grout.

If leveling nuts are used, make sure they are not embedded in grout. Provide access in the grout to the leveling nuts so that they can be backed off after the grout has cured. Allow the grout to fully cure before backing off the leveling nuts (if used) and firmly tightening the foundation bolts. Then recheck the alignment before connecting the piping.

PIPING

WARNING

DO NOT OPERATE THE PUMP IF YOU ARE EXPERIENCING EXCESSIVE SYSTEM LIFE SURGES. CONSULT WITH YOUR DESIGN ENGINEER.

CAUTION

ALL PIPING CONNECTIONS MUST BE MADE WITH THE PIPE IN A FREE SUPPORTED STATE, AND WITHOUT THE NEED TO APPLY VERTICAL OR SIDE PRESSURE TO OBTAIN ALIGNMENT OF THE PIPING WITH THE PUMP DISCHARGE FLANGE. DO NOT USE PUMP TO SUPPORT DISCHARGE PIPING.

CAUTION

AFTER ALL THE PIPING IS CONNECTED, THE PUMP AND DRIVER ALIGNMENT MUST BE RECHECKED.

All piping should be independently supported near the pump so that pipe strain will not be transmitted to the pump volute. The suction and discharge piping should be one or two sizes larger than the pump flange sizes. Any flexible joints installed in the piping must be equipped with tension rods to absorb piping axial thrust.

The suction pipe must be air tight and sloped upward to the pump flange to avoid air pockets which will impair satisfactory pump operation. The discharge pipe should be as direct as possible with a minimum of valves to reduce pipe friction losses.

A check valve and gate valve should be installed in the discharge line and a gate valve in the suction line. The check valve between the pump and gate valve should protect the pump from water hammer. Never throttle a pump by use of a suction gate valve.

AUXILIARY PIPING CONNECTIONS AND GAUGES.

In addition to the primary piping connections, your pump may require connections to the mechanical seal and seal filter (see the "stuffing box" and "mechanical seal" sections of this manual), stuffing box drain, discharge and suction flange pressure gauges, or base plate drain connections. All lines and gauges should now be installed.

PUMP VENTING

All vertical style pumps require a vent to allow air to escape from behind the impeller and prevent air binding. The vent should be piped back to the wet well or sump pump pit. Pump vent should be checked on a regular maintenance schedule.

FINAL COUPLING ALIGNMENT

The alignment of the coupling must be carefully checked during the installation and as the last step before starting the pump. If realignment is required, the piping should be disconnected first. After aligning, reconnect the piping in accordance with the previous instructions and again recheck the alignment.

A flexible coupling must not be used to compensate for misalignment resulting from poor installation or temperature changes.

ESSCO pumps are available with many different types of commercial couplings. Always check the coupling manufacturer's instruction manual prior to final alignment.

WARNING

CHECK SAFETY CODES, AND ALWAYS INSTALL PROTECTIVE GUARD OR SHIELD AS REQUIRED BY THE VARIOUS FEDERAL, STATE AND LOCAL LAWS AND THE REGULATIONS CONCERNING OSHA.

WARNING

COUPLING SLEEVES MAY BE THROWN FROM THE ASSEMBLY WHEN SUBJECTED TO A SEVERE SHOCK LOAD.

DOWELLING

When dowelling is required after the piping is connected and the final coupling alignment completed, the pump and driver should be drilled, reamed and dowelled to the baseplate using a minimum of two dowels each for the pump and driver.

VERTICAL FLEXIBLE SHAFTING ALIGNMENT

WARNING

THE WEIGHT OF THE INTERMEDIATE SHAFT MUST NOT BE SUPPORTED BY THE PUMP BEARINGS. IF THE WEIGHT OF THE SHAFT CANNOT BE SUPPORTED BY THE DRIVER BEARINGS, A SPECIAL THRUST BEARING SHOUD BE INSTALLED IMMEDIATELY BELOW THE MOTOR.

For installation and alignment of the intermediate flexible shafting, refer to the manufacturer's installation guide.

ROTATION

Before connecting the coupling halves, bump start the motor and verify rotation is in the proper direction. The correct pump rotation is indicated by an arrow on the pump casing.

MECHANICAL SEALS

CAUTION

DRY OPERATION OF THE PUMP WILL CAUSE DAMAGE TO THE MECHANICAL SEAL.

Double mechanical seals must be lubricated and cooled by clean or filtered liquid supplied to the bottom (lowest) seal housing pipe connection. Before starting the pump, all air and oil used for storage protection must be flushed out through the upper (highest) seal housing pipe connection.

TYPICAL-DOUBLE MECHANICAL SEAL

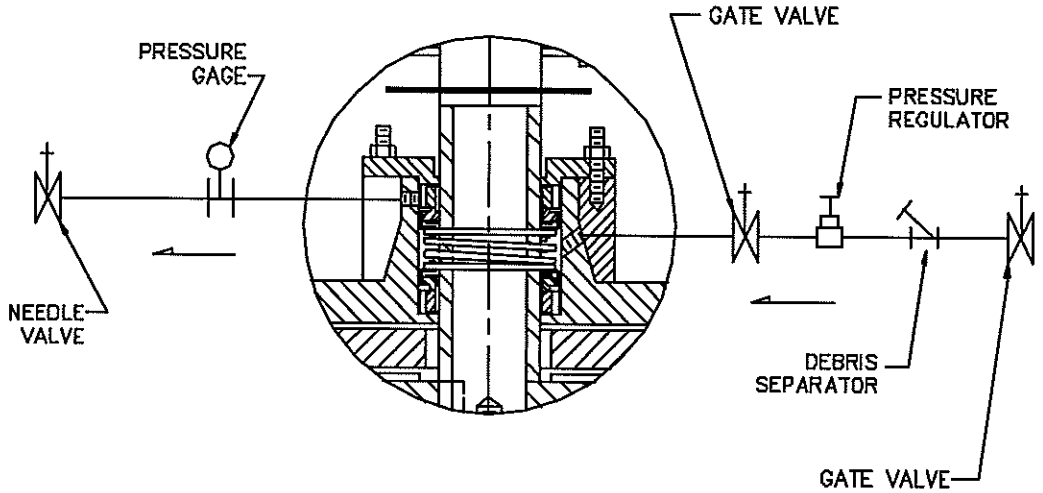
If an outside source of seal liquid is used, a pressure of 5 to 10 PSI higher than maximum pump discharge pressure must be maintained in the seal housing.

For operation of mechanical seals at higher pressure, circulation of the liquid may be required. Refer to the seal manufacturer for specific details.

Because of the many possible combinations of pumps and motors (drivers) this booklet is not meant to be a specific application operating manual. However, there are general rules and practices that apply to all pump installations and operation.

WARNING

BEFORE APPLING POWER TO PUMP MOTOR CHECK SUPPLY VOLTAGE TO BE SURE IT IS CORRECT. BE SURE MOTOR IS WIRED FOR CORRECT VOLTAGE.



CAUTION

BEFORE STARTING OR OPERATING THE PUMP, READ THIS ENTIRE MANUAL, ESPECIALLY THE FOLLOWING INSTRUCTIONS.

A. PRIOR TO STARTING THE PUMP, ROTATE THE SHAFT ASSEMBLY BY HAND TO ASSURE ALL MOVING PARTS ARE NOT BOUND.

B. PRIOR TO STARTING THE PUMP, INSTALL GUARDS AROUND ALL EXPOSED ROTATING PARTS.

C. OBSERVE AND HEED ALL CAUTION OR DANGER TAGS ATTACHED TO THE EQUIPMENT.

D. BEFORE STARTING THE PUMP, FILL THE CASING AND SUCTION LINE WITH LIQUID. THE PUMP MAY BE PRIMED BY USING A PRIMING SYSTEM.

E. BEFORE STARTING A MECHANICAL SEAL PUMP, TURN ON THE SEAL WATER, VENT THE SEAL HOUSING AND CONFIRM SEAL WATER IS AT SUFFICIENT PRESSURE.

F. BEFORE STARTING A PACKED BOX PUMP, ADJUST THE PACKING GLAND SO THERE IS SUFFICIENT LEAKAGE TO LUBRICATE THE PACKING AND ASSURE A COOL STUFFING BOX(SEE MAINTENANCE INSTRUCTIONS).

IF EXCESSIVE VIBRATION OR NOISE OCCURS DURING OPERATION, SHUT THE PUMP DOWN AND CONSULT AN ESSCO REPRESENTATIVE.

OPERATING AT REDUCED CAPACITY

In a typical application covering a wide range of flow rates, a variable speed driver is often used to adjust pump capacity and this is taken into consideration by **ESSCO** when selecting the pump and impeller trim. Although these pumps are applicable over a wide range of operating conditions, care should be exercised when doing so, especially when the actual conditions differ from the sold for conditions. You should always contact your nearest ESSCO representative before operating the pumps at any condition other than that for which they were sold.

INITIAL STARTUP OF THE PUMPS

MECHANICAL SEALS

For Dry Pit pumps be sure the vent valve is open to allow air to escape from the volute. If the vent valve is not open an air pocket can form and cause damage to the mechanical seal.

A. After the pump is installed close the discharge valve closed and start the motor according to the manufacturer's instructions.

B. Open the discharge valve slowly to prevent water hammer, and to allow the discharge line to fill completely.

C. Monitor the motor amperage as the discharge gate valve is opened. Do not exceed the service factor of the motor or extreme damage to the motor may occur.

CAUTION

DRY OPERATION OF THE PUMP WILL CAUSE DAMAGE TO THE MECHANICAL SEAL. MAKE ABSOLUTELY CERTAIN THE VOLUTE IS PRIMED.

STUFFING BOX WITH PACKING

CAUTION

EXTREME CARE SHOULD BE TAKEN WHEN ADJUSTING PACKING. THE PUMP WILL BE IN OPERATION AND SEVERE INJURY CAN BE SUSTAINED IF YOU ARE NOT PAYING ATTENTION. KEEP FINGERS, CLOTHING AND JEWLERY AWAY FROM ALL ROTATING PUMP COMPONENTS!!

For Dry Pit pumps with a stuffing box and packing there a 3 common arrangements:

1. Product lubricated packing. This is the most common arrangement where the pumped liquid is used to cool and lubricate the packing. The last ring of packing is normally shipped loose and is to be installed during equipment start up. There are two stainless steel studs on the stuffing box with stainless steel nuts and washers. The pump(s) are shipped with the packing nuts slightly tightened. Upon start up of the pump(s) the packing nuts should be loosened to allow the pumped liquid to lubricate the packing. After starting the pump the packing gland should be tightened to allow a small stream of liquid leak out. The packing nuts should be tightened slowly and continuously until the gland bottoms out making room for the final ring of packing.

   Before adding the last ring of packing be sure to disconnect the power to the pump.

   After the pump shaft stops rotating loosen the nuts on the packing gland and insert the last ring of packing. Hand tighten the packing gland nuts prior to re-starting the pump. With the pump in operation slowly tighten the packing gland nuts one half turn per side. Do not over tighten or you will damage the shaft sleeve.

   The packing will require a 4-6 hour break-in period. Be patient or you will damage the shaft sleeve which will not be covered under warranty.

Once the last ring of packing is installed the packing gland should drip a minimum of 25 drops per minute.

2. Water flushed packing. Connect the water flush line to the packing box. The flush water will enter the stuffing box through the lantern ring and lubricate the packing. ***Be sure the flush water always starts before the pump begins operation.***

   The flush water pressure should a minimum of 10 PSI greater than the discharge pressure and the flush water temp should be no more than 120° F.

   For start up procedure follow the instructions in section 1 under this heading.

3. A third common method of lubricating the packing is with grease. If this method is used then a spring loaded automatic grease lubricator must be installed on the stuffing box flush connection. The spring tension must be greater than the discharge pressure when the pump is in operation. The grease lubricator must be kept full in order to insure proper distribution of grease to the lantern ring. ***For gritty applications this is not a recommended packing lubrication.***

BEARING OPERATING TEMPERATURE

ESSCO pumps are designed to operate over a wide ambient temperature range. The bearing temperature, when measured on the outside surface of the bearing housing, should not exceed 190 deg. F. Temperature in excess of 190 deg. F may indicate a lack of lubricant, bearing overload or potential bearing failure. If the temperature exceeds this limit, the pump should be stopped and the cause investigated and corrected immediately to prevent damage.

For Oil Lubricated Bearing use SAE 20 non-detergent oil.

For Grease Lubricated use Mobilgrease XHP222 Special Premium Lubricating Grease with Moly or equal.

Service	Example	Lubrication Interval
Easy	Infrequent Operation	Annually
Standard	Two Shifts per Day	Six Months
Severe	Continuous Operation	Three Months
Extreme	Dirty Locations and/or High Ambient Temp.	Two Months

TROUBLESHOOTING

CAUTION

PRIOR TO WORKING ON ANY ELECTRICAL OR PUMP EQUIPMENT, SAFETY ELECTRICAL LOCKOUT CIRCUITS SHOULD BE INSTALLED AND LOCKED OUT TO PREVENT SERIOUS INJURY OR DEATH. REVIEW ALL LOCAL, STATE, FEDERAL CODES AND OSHA REQUIREMENTS BEFORE WORKING ON ANY PUMPING EQUIPMENT.

SAFETY IS YOUR RESPONSIBILITY

VORTEX PUMP TROUBLESHOOTING

If you have followed the installation and startup procedures outlined in this manual, your pump should provide reliable service and long life. However, if operating problems do occur, significant time and expense can be saved if you use the following check list to eliminate the most common causes of those problems.

IF THE PUMP IS OPERATING IN THE REVERSE ROTATION, THE MOTOR WILL DRAW UP TO 50% MORE AMPERAGE THAN WHEN OPERATING IN THE CORRECT ROTATION.

INSUFFICIENT DISCHARGE PRESSURE OR FLOW

1. Pump not primed or vents plugged.
2. Speed too low. Check driver.
3. Discharge head too high.
4. Air leaks into suction piping, stuffing box or gaskets.
5. Impeller damaged.
6. Insufficient suction line submergence.
7. Air in liquid.
8. Impeller diameter too small.
9. Insufficient net positive suction head.
10. Suction line partially plugged.
11. Discharge valves not open.

LOSS OF SUCTION DURING OPERATION

1. Suction line leaks.
2. Water seal line to packing box is plugged.
3. Air or gases in liquid.
4. Air leaks into suction piping, stuffing box or gaskets.
5. Wrong direction of rotation.
6. Insufficient suction lift submergence.

EXCESSIVE POWER CONSUMPTION

1. Pumps are running in wrong direction.
2. Speed too high.
3. Head lower than rating, pumps too much liquid.
4. Specific gravity or viscosity of liquid pumped is too high.
5. Mechanical defects: Shaft bent. Rotating element binds.
6. Misalignment
7. Incorrect diameter impeller.

VIBRATION OR NOISE

1. Misalignment between driver and pump.
2. Foundation bolts loose or defect in grouting.
3. Mechanical defects: Shaft bent. Rotating element binds.
4. Head lower than rating, pumps too much liquid.
5. Pump strain- improperly supported or aligned.
6. Pumps running at shut-off condition.
7. Insufficient suction line submergence.
8. Air in liquid.
9. Suction line partially plugged.
10. Suction line too small.
11. Suction line too long.

OVER-HEATING

1. Bearings (grease lube)
   - Excessive grease
   - Shaft bent
   - Rotating element binds
   - Pipe strain
   - Insufficient bearing lubrication
   - Incorrect type grease

2. Packing box:
   - Packing gland too tight
   - Air not vented out of volute
   - Flush water not circulating

3. Bearings (oil lube)
   - Oil level too low
   - Oil level too high
   - Shaft bent
   - Pipe strain
   - Bearing binding

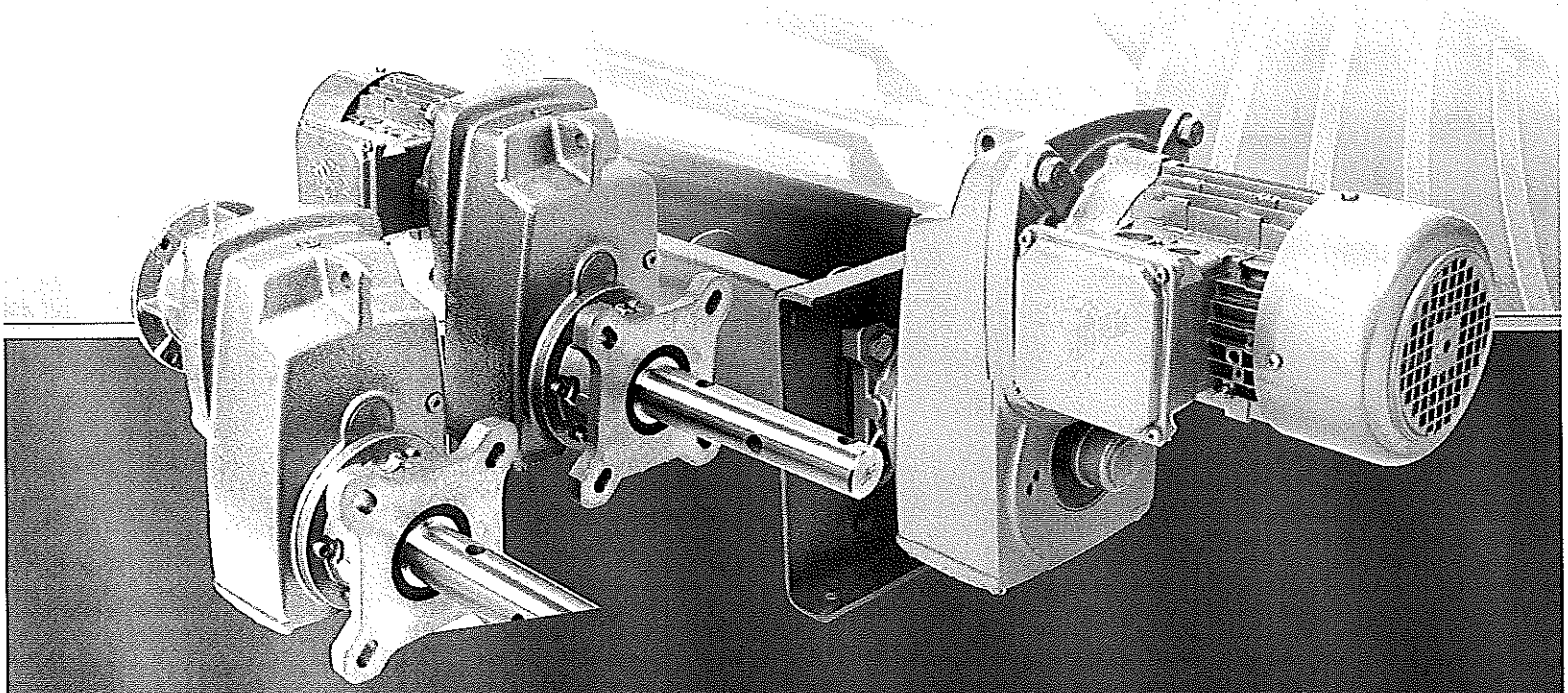
PREVENTATIVE MAINTENANCE LOG

Pump Model Number:		Pump Serial Number:	
Date	ETM Hour Meter Reading	Amp Reading	Comments

GRIT WASHER

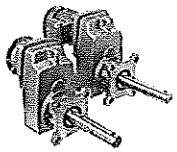
SCREW CONVEYOR PACKAGE GEARMOTORS & SPEED REDUCERS

SIMPLE, RELIABLE, EFFICIENT



UNICASE™
CLINCHER™
F1129

NORD GEAR
DRIVESYSTEMS

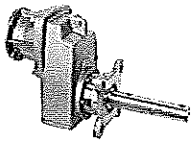


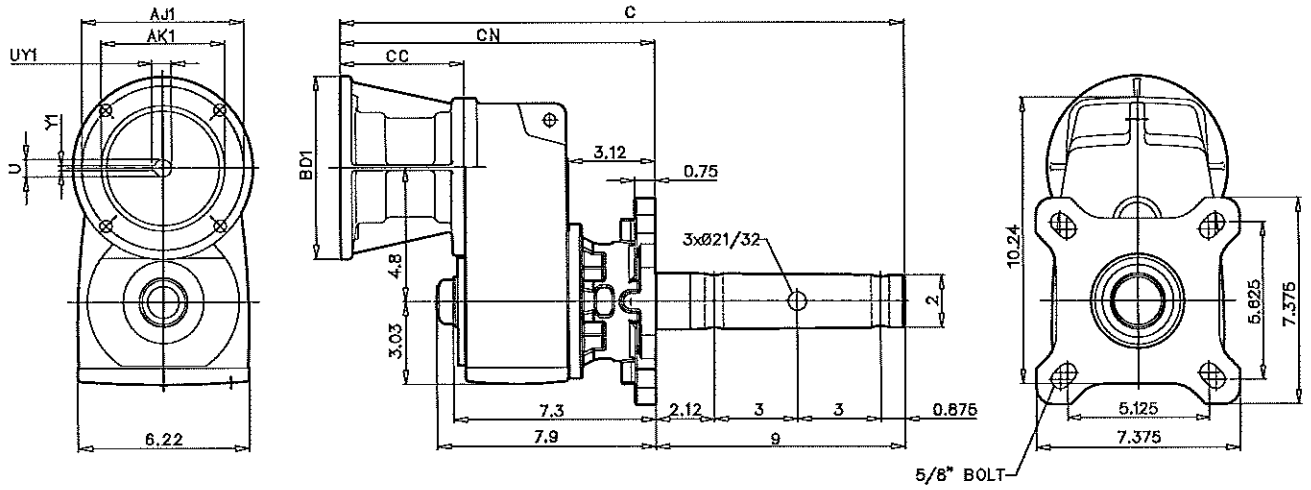
SK 1282 SCP & SK 1382 SCP
Ratings & Combinations

Type	Ratio	Output Speed 1750 rpm input n_2 [rpm]	Max Torque T_{max} [lb-in]	Max Power 1750 rpm Input P_{max} [hp]	NEMA C-face			Integral Motor									
					56C	140TC	180TC	63S/4	63L/4	71S/4	71L/4	80S/4	80L/LH/4	90S/SH/4	90L/LH/4	100L/LH/4	100LA/ 112MH/4
					1 hp	2 hp	5 hp	0.16 hp	0.25 hp	0.33 hp	0.5 hp	0.75 hp	1 hp	1.5 hp	2 hp	3 hp	5 hp
SK 1282 SCP	4.79	365	1133	* 5.00	X	X	X	X	X	X	X	X	X	X	X	X	X
	5.47	320	1522	* 5.00	X	X	X	X	X	X	X	X	X	X	X	X	X
	6.43	272	1602	* 5.00	X	X	X	X	X	X	X	X	X	X	X	X	X
	7.24	242	1655	* 5.00	X	X	X	X	X	X	X	X	X	X	X	X	X
	8.21	213	1416	4.78	X	X	X	X	X	X	X	X	X	X	X	X	X
	8.24	212	1690	* 5.00	X	X	X	X	X	X	X	X	X	X	X	X	X
	9.18	191	1673	* 5.00	X	X	X	X	X	X	X	X	X	X	X	X	X
	10.34	169	1735	4.65	X	X	X	X	X	X	X	X	X	X	X	X	X
	11.76	149	1805	4.27	X	X	X	X	X	X	X	X	X	X	X	X	X
	14.11	124	1859	3.66	X	X	X	X	X	X	X	X	X	X	X	X	X
	17.21	102	1982	3.21	X	X	X	X	X	X	X	X	X	X	X	X	X
	20.57	85	1991	2.68	X	X	X	X	X	X	X	X	X	X	X	X	X
	25.22	69	1991	2.18	X	X	X	X	X	X	X	X	X	X	X	X	X
	28.33	62	1991	1.96	X	X		X	X	X	X	X	X	X	X		
	32.08	55	2036	1.78	X	X		X	X	X	X	X	X	X	X		
	41.07	43	1920	1.31	X	X					X	X	X				
	46.19	38	1735	1.05	X			X	X	X	X						
	49.25	36	2301	1.31	X	X					X	X	X				
	55.39	32	2080	1.06	X			X	X	X	X						
	58.89	30	2505	1.19	X	X					X	X	X				
	66.23	26	2390	0.99	X			X	X	X	X						
	72.17	24	2620	1.00	X	X					X	X	X				
	81.17	22	2620	0.91	X			X	X	X	X						
	92.48	19	2053	0.62	X			X	X	X	X						
	109.50	16	1850	0.47	X			X	X	X							
SK 1382 SCP	87.94	20	2425	0.77	X			X	X	X	X						
	105.11	17	2390	0.63	X			X	X	X	X						
	128.82	14	1991	0.43	X			X	X	X	X						
	163.93	11	1991	0.34	X			X	X	X	X						
	209.67	8.5	2080	0.28	X			X	X	X	X						
	251.67	7.0	2425	0.27	X			X	X	X	X						
	300.93	5.8	2390	0.22	X			X	X	X	X						
	368.79	4.8	1991	0.15	X			X	X	X	X						
	414.78	4.2	1991	0.13	X			X	X	X	X						
	472.60	3.7	1991	0.12	X			X	X	X	X						
	556.83	3.1	1991	0.10	X			X	X	X							
	634.45	2.8	1965	0.09	X			X	X	X							

* Maximum power listed is limited by the largest motor combination. This is not a thermal or mechanical power limit for the gear unit.

When Selecting NEMA C-face reducer, do not exceed the power listed for the NEMA input size in the table. The powers shown are based on 4-pole (1750 rpm) motor speeds ads will vary for other motor speeds.





Dimensions in Inches
DIMENSIONS

NEMA C-Face Input	Overall		NEMA Input				Coupling		
	C	CN	CC	BD1	AJ1	AK1	U	UY1	Y1
56C	20.35	11.35	4.45	6.54	5.875	4.500	0.625	0.71	0.188
140TC	20.35	11.35	4.45	6.54	5.875	4.500	0.875	0.96	0.188
180TC	21.55	12.55	5.65	9.17	7.250	8.500	1.125	1.24	0.250

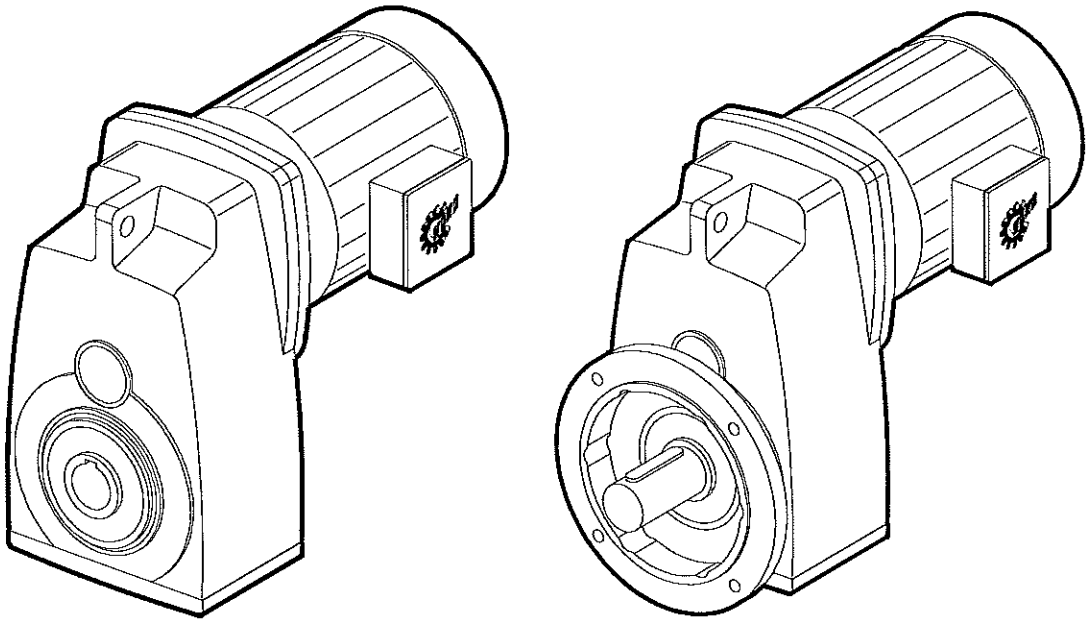
UNICASE® Shaft Mount Gearboxes
Installation and Maintenance Instructions

BIM 1020

USA

CDN

Retain These Safety Instructions For Future Use



INSPECTION OF UNIT

Thoroughly inspect the equipment for any shipping and handling damage before accepting shipment from the freight company. If any of the goods called for in the bill of lading or express receipt are damaged or the quantity is short, do not accept until the freight or express agent makes an appropriate notation on your freight bill or express receipt. If any concealed loss or damage is discovered later, notify your freight carrier or express agent at once and request him to make an inspection. We will be very happy to assist you in collecting claims for loss or damage during shipment; however, this willingness on our part does not remove the transportation company's responsibility in reimbursing you for collection of claims or replacement of material. Claims for loss or damage in shipment must not be deducted from the NORD Gear invoice, nor should payment of the NORD Gear invoice be withheld awaiting adjustment of such claims, as the carrier guarantees safe delivery.

If considerable damage has been incurred and the situation is urgent, contact the nearest NORD Gear Sales Office for assistance. Please keep a written record of all communications.

RECORD NAMEPLATE DATA

Locate the gear reducer nameplate and record all nameplate data for future reference.

SK _____ S/N _____

RATIO _____ MAX TORQUE _____ RPM _____ MTG. POS _____

STORAGE

PROPER STORAGE UNTIL INSTALLED

Keep unit in a dry, temperature controlled area. If stored other than said, long term storage methods must be applied to the unit including complete fill with lubricant. Protect machined surfaces and rotate shafts periodically. Prior to putting unit into service, drain lubricant and refill to proper level as determined by the mounting position.

PROPER HANDLING OF THE UNIT

Exercise care to prevent damage to the unit when moving. Lift only at designed lifting points. Do not attach other machinery and lift by the unit lifting points. The lifting points are to be used to lift the unit only. Insure that adequate safety measures are taken to protect personnel during transportation. Protect the mounting surface from damage.

INSTALLATION OF UNIT

To ensure long service and dependable performance, an enclosed gear drive must be rigidly supported and the shafts accurately aligned. The following describes the minimum precautions required to accomplish this end.

FOUNDATION
The responsibility for the design and construction of the foundation lies with the user. The foundation must be adequate to withstand normal operating loads and possible overloads while maintaining alignment to attached system components under such loads.

MOUNTING POSITION
Unless a unit is specifically ordered for inclined mounting, the foundation must be level and flat. The lubrication system may not operate properly if the unit is not mounted in the position for which it is designed. It may be desirable to elevate the foundation to facilitate oil drainage.

CONCRETE FOUNDATION
If a concrete foundation is used, steel mounting pads and bolts of sufficient size to distribute the stress into the concrete should be grouted into the foundation.

STEEL FOUNDATION
If a structural steel foundation is used (i.e. wide flange beams or channels), a base plate or sole plate of suitable thickness should be used and should extend under the entire unit.

FOOT MOUNTED UNITS
Use shims under the feet of the unit to align the output shaft to the driven equipment. Make sure that all feet are supported so that the housing will not distort when it is bolted down. Improper shimming will reduce the life of the unit and may cause failure. Dowel pins may be installed to prevent misalignment and ensure proper realignment if removed for service.

SHAFT MOUNTED UNITS
Shaft mounted drives should be mounted as close to the driven equipment bearing support as possible to minimize bearing loads due to overhung load. Design of the joint connection between the torque reaction arm and the foundation is the user's responsibility.

Hollow Shaft Diameter tolerance
Metric (mm)

≤ Ø 18 = +0.018/-0.000
> Ø 18 ≤ Ø 30 = +0.021/-0.000
> Ø 30 ≤ Ø 50 = +0.025/-0.000
> Ø 50 ≤ Ø 80 = +0.030/-0.000
> Ø 80 ≤ Ø 120 = +0.035/-0.000
> Ø 120 ≤ Ø 180 = +0.040/-0.000

Inch

≤ Ø 4.375 = +0.0010 / -0.0000
> Ø 4.375 = +0.0015 / -0.0000

Customer shaft diameter tolerances with keyed hollow shafts
Metric (mm)

≤ Ø 18 = +0.000/-0.011
> Ø 18 ≤ Ø 30 = +0.000/-0.013
> Ø 30 ≤ Ø 50 = +0.000/-0.016
> Ø 50 ≤ Ø 80 = +0.000/-0.019
> Ø 80 ≤ Ø 120 = +0.000/-0.022
> Ø 120 ≤ Ø 180 = +0.000/-0.025

Inch

≤ Ø 1.500 = +0.000/-0.002
> Ø 1.500 ≤ Ø 2.500 = +0.000/-0.003
> Ø 2.500 ≤ Ø 7.000 = +0.000/-0.004

Shaft finish to be 125 micro inches or smoother.

Customer shaft diameter tolerance with Shrink Disc fit h6
Metric (mm)

≤ Ø 18 = +0.000/-0.011
> Ø 18 ≤ Ø 30 = +0.000/-0.013
> Ø 30 ≤ Ø 50 = +0.000/-0.016
> Ø 50 ≤ Ø 80 = +0.000/-0.019
> Ø 80 ≤ Ø 120 = +0.000/-0.022
> Ø 120 ≤ Ø 180 = +0.000/-0.025

Inch

≤ Ø 0.750 = +0.0000/-0.0004
> Ø 0.750 ≤ Ø 1.125 = +0.0000/-0.0005
> Ø 1.125 ≤ Ø 2.000 = +0.0000/-0.0006
> Ø 2.000 ≤ Ø 3.000 = +0.0000/-0.0007
> Ø 3.000 ≤ Ø 4.750 = +0.0000/-0.0008
> Ø 4.750 ≤ Ø 7.000 = +0.0000/-0.0010

Shaft finish to be 125 micro inches or smoother.

Customer shaft diameter tolerance with Shrink Disc fit f6 (looser fit)
Metric (mm)

≤ Ø 18 = -0.016/-0.024
> Ø 18 ≤ Ø 30 = -0.020/-0.029
> Ø 30 ≤ Ø 50 = -0.025/-0.036
> Ø 50 ≤ Ø 80 = -0.030/-0.043
> Ø 80 ≤ Ø 120 = -0.036/-0.051
> Ø 120 ≤ Ø 180 = -0.043/-0.061

Inch

≤ Ø 0.750 = -0.0006/-0.0011
> Ø 0.750 ≤ Ø 1.125 = -0.0008/-0.0013
> Ø 1.125 ≤ Ø 2.000 = -0.0010/-0.0016
> Ø 2.000 ≤ Ø 3.000 = -0.0012/-0.0019
> Ø 3.000 ≤ Ø 4.750 = -0.0014/-0.0023
> Ø 4.750 ≤ Ø 7.000 = -0.0017/-0.0027

Shaft finish to be 125 micro inches or smoother

FLANGE MOUNTED UNITS
If a structural steel foundation is used (i.e. wide flange beams or channels), a base plate or sole plate of suitable thickness should be used and should extend under the entire unit. If a bulk head plate is used it should be of proper strength to minimize buckling distortions.

Flange Pilot 'AK' or 'AK1' tolerance
Metric (mm)

> Ø 50 ≤ Ø 80 = +0.012/-0.007
> Ø 80 ≤ Ø 120 = +0.013/-0.009
> Ø 120 ≤ Ø 180 = +0.014/-0.011
> Ø 180 ≤ Ø 230 = +0.016/-0.013
> Ø 230 ≤ Ø 315 = +0.000-0.032
> Ø 315 ≤ Ø 400 = +0.000/-0.036
> Ø 400 ≤ Ø 500 = +0.000/-0.040

Inch

> Ø 1.969 ≤ Ø 3.150 = +0.005/-0.0003
> Ø 3.150 ≤ Ø 4.724 = +0.005/-0.0004
> Ø 4.724 ≤ Ø 7.087 = +0.006/-0.0004
> Ø 7.087 ≤ Ø 9.055 = +0.006/-0.0005
> Ø 9.055 ≤ Ø 12.402 = +0.000/-0.0013
> Ø 12.402 ≤ Ø 15.748 = +0.000/-0.0014
> Ø 15.748 ≤ Ø 19.685 = +0.000/-0.0016

BOLT STRENGTH
Bolt size, strength and quantity should be verified to insure proper torque reaction capacity whatever the mounting arrangement.

LUBRICATE SHAFTS
Both the hollow shaft and the driven shaft should be liberally lubricated before assembly. The unit must slide freely onto the driven shaft. Do not hammer or force the unit into place. For shrink disc, follow instructions below.

AXIAL RETENTION
Each drive shaft must be retained in place relative to the gear reducer. Or each gear reducer must be retained in place relative to the drive shaft. Either way NORD recommends the use of shaft shoulders, locking collars or FIXING ELEMENTS to axially retain the shaft or gear reducer in position.

SET SCREWS
If set screws are used for axial retention, they should be tightened evenly. Flats may be filed on the driven shaft and a thread-locking adhesive used for more position retention.

SNAP RING RETENTION
Placing external snap rings on drive shafts must be performed with caution. The groove, which the snap ring fits into, may weaken the drive shaft causing premature failure. NORD does not recommend this type of shaft retention.

THRUST PLATE
In applications, which are subject to high vibratory loads, a thrust plate will provide greater resistance to axial movement. Follow the manufacturer's recommendations for assembly.

SHRINK DISC
If a shrink disc is used to secure a reducer hollow shaft to the driven shaft, follow this assembly procedure. Start with the shrink disc mounted onto the extension of the hollow shaft disc locking bolts loosened.

1. Clean reducer bore and mating solid shaft to be free of any lubricants or dirt.
2. Slide reducer onto the solid shaft until it is about half way through.
3. Lubricate the remaining portion of the solid shaft with a #2 grease or similar lubricant. This part will be located under the bronze bushing. **Do not install grease under the shrink disc gripping area.** Finish installing the solid shaft into the reducer hollow bore.
4. Finger tighten all shrink disc bolts. Now, moving a circular pattern, tighten each shrink disc locking bolt 1/4 to 1/2 turn. **Do not use criss cross pattern.** Continue tightening in the same circular direction with 1/4 or 1/2 turn increments until all bolts reach the specified bolt tightening torque. Bolt tightening torque is shown on the shrink disc label for the particular unit.
5. Run unit for 24 hours, then retighten shrink disc locking bolts to the proper bolt torque as indicated above.

TORQUE REACTION ARM
On the shaft mount 'Clincher', torque is reacted through the integral torque tab, which is part of the casting. Commonly, NORD's optional RUBBER BUFFER bushings are installed on each side of the integral torque tab to dampen torque shocks and allow for mis-alignment received from the machinery during operation.

Torque arm connection fabrications should always be mounted perpendicular to a line through the output shaft center and the point at attachment of the torque arm to the unit housing. In this position the minimum load on the attachment structure arm will be experienced. The attachment structure must be rigid and may not deflect under any load. Doing so will place extra loads on the output bearings of the reducer.

PRIME MOVER MOUNTING
Align the prime mover to the reducer-input shaft using shims under the feet. Make sure that the feet are supported. Dowel the prime mover to its foundation.

SHAFT CONNECTIONS
When connecting shafts to either the input or output of the reducer, consider the following instructions.

FITS
Clearance or interference fits for coupling hubs should be in accordance with ANSI/AGMA 9002-A86 or as follows.

Output and Input shaft Diameter tolerance
Metric (mm)

≤ Ø 18 = +0.012/+0.001
> Ø 18 ≤ Ø 30 = +0.015/+0.002
> Ø 30 ≤ Ø 50 = +0.018/+0.002
> Ø 50 ≤ Ø 80 = +0.030/+0.011
> Ø 80 ≤ Ø 120 = +0.035/+0.013
> Ø 120 ≤ Ø 180 = +0.040/+0.015

Inch

≤ Ø 1.750 = +0.0000/-0.0005
> Ø 1.750 = +0.0000/-0.0010

Output and Input shaft Drill and tap shaft end
Metric (mm)

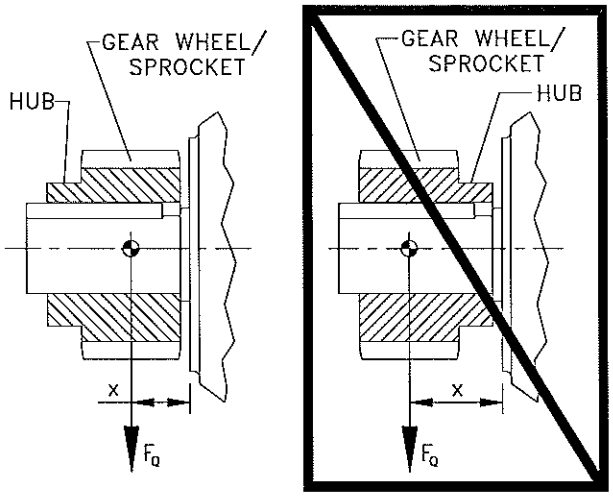
≤ Ø 16 = M5
> Ø 16 ≤ Ø 21 = M6
> Ø 21 ≤ Ø 24 = M8
> Ø 24 ≤ Ø 30 = M10
> Ø 30 ≤ Ø 38 = M12
> Ø 38 ≤ Ø 50 = M16
> Ø 50 ≤ Ø 85 = M20
> Ø 85 ≤ Ø 130 = M24

Inch

≤ Ø 0.438 = #10-24 x 0.4 deep
> Ø 0.438 ≤ Ø 0.813 = 1/4-20 x 0.6 deep
> Ø 0.813 ≤ Ø 0.938 = 5/16-18 x 0.7 deep
> Ø 0.938 ≤ Ø 1.125 = 3/8-16 x 0.9 deep
> Ø 1.125 ≤ Ø 1.375 = 1/2-13 x 1.1 deep
> Ø 1.375 ≤ Ø 1.875 = 5/8-11 x 1.4 deep
> Ø 1.875 ≤ Ø 3.250 = 3/4-10 x 1.7 deep
> Ø 3.250 = 1-8 x 2.2 deep

Outboard pinion and sprocket fits should be as recommended by the pin sprockets with interference fits should be heated according to the manufacturer's recommendations, generally 250°F to 300°F, (120°C to 150° C) before assembling to the shaft.

LOCATION
Coupling hubs should be mounted flush with the shaft ends, unless specifically ordered for overhung mounting. Pinions,



CORRECT INCORRECT

sprockets and sheaves should be mounted as close as possible to the unit housing to minimize bearing loads and shaft deflections.

COUPLING ALIGNMENT
Shaft couplings should be installed according to the coupling manufacturer's recommendations for gap, angular and parallel alignment. In many installations, it is necessary to allow for thermal and mechanical shaft movement when determining shaft alignment. The coupling manufacturer's recommendations should be followed.

AXIAL DISPLACEMENT
The gap between shaft ends should be the same as the specified coupling gap unless overhung mounting of the coupling hub is specified. The coupling gap and shaft gap must be sufficient to accommodate any anticipated thermal or mechanical axial movement.

ANGULAR ALIGNMENT
Insert a spacer or shim stock equal to the required coupling gap between the coupling hub faces and measure the clearance using feeler gauges. Repeat this at the same depth at 90-degree intervals to determine the amount of angular misalignment.

PARALLEL ALIGNMENT
Mount a dial indicator to one coupling hub, and rotate this hub, sweeping the outside diameter of the other hub. The parallel misalignment is equal to one-half of the total indicator reading. Another method is to rest a straight edge squarely on the outside diameter of the hubs at 90-degree intervals and measure any gaps with feeler gauges. The maximum gap measurement is the parallel misalignment.

CHECKING ALIGNMENT
After both angular and parallel alignments are within specified limits, tighten all foundation bolts securely and repeat the above procedure to check alignment. If any of the specified limits for alignment are exceeded, realign the coupling.

SPROCKET OR SHEAVE ALIGNMENT
Align the sheaves or sprockets square and parallel by placing a straight edge across their faces. Alignment of bushed sheaves and sprockets should be checked after bushings have been tightened. Check horizontal shaft alignment by placing a level vertically against the face of the sheave or sprocket. Adjust belt or chain tension per the manufacturer's specified procedure.

OUTBOARD PINION ALIGNMENT
Align the pinion by adjusting the gear tooth clearance according to the manufacturer's recommendations and checking for acceptable outboard pinion tooth contact. The foundation bolts may have to be loosened and the unit moved slightly to obtain this contact. When the unit is moved to correct tooth contact, the prime mover should be realigned.

RECHECK ALIGNMENT
After a period of operation, recheck alignment and adjust as required.

1. Properly install unit on a rigid foundation
   - adequately supported
   - securely bolted into place
   - leveled so as not to distort the gear case
2. Properly install couplings suitable for the application and connected equipment.
3. Ensure accurate alignment with other equipment.
4. Furnish and install adequate machinery guards as needed to protect operating personnel and as required by the applicable standards of the Occupational Safety and Health Administration (OSHA), and by other applicable safety regulations;
5. Ensure that driving equipment is running in the correct direction before coupling to reducers with backstops (designed to operate only in a specific direction) or machinery designed to operate only in one direction.

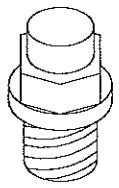
CHANGES IN PERFORMANCE SPECIFICATIONS
Owner has the responsibility to consult with NORD GEAR if such items such as applied loads, operating speeds or other operating conditions have changed.

⚠ WARNING:

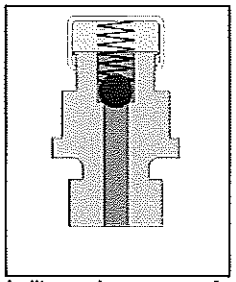
LOCK OUT POWER before any maintenance is performed. Make absolutely sure that no voltage is applied while work is being done on the gearbox.

START-UP
1. Ensure that switches, alarms, heaters, coolers and other safety and protection devices are installed and operational for their intended purpose.
2. Verify that the installed mounting position is the same as the nametag mounting position. If not, adjust the oil level accordingly and relocate the vent plug, fill plug and drain plug according to the mounting position. See following.

AUTOVENT PLUG
The Autovent plug is brass in color and will be located at the highest point on the gearbox. It operates like a check-valve to allow the reducer to relieve internal pressure while preventing lubricant contamination during cooling. A spring presses a ball or plunger against a machined orifice until pressure exceeds 2 psi. Above 2 psi the air is allowed to escape depressurizing the gearcase. When internal pressure drops below 2 psi, the autovent re-seals closing the unit to the outside environment. After shutdown, the reducer cools along with the air inside the reducer. The unit will temporarily maintain a slight vacuum until normalization occurs. NORD Gear supplies an Autovent as a standard feature.

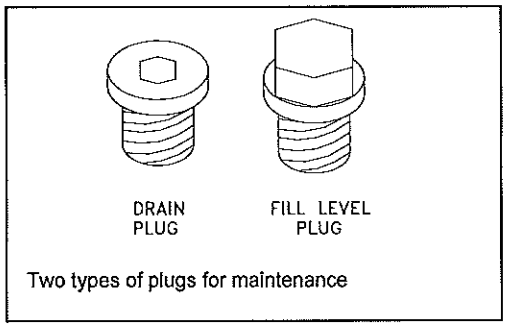


AUTOVENT PLUG



The Autovent releases built-up air pressure from inside the gearbox (Max. pressure 2 psi).

FILL LEVEL & DRAIN PLUGS
The drain plugs are metric socket head cap screws. They will be located at the lowest part of the gearbox for ease of draining. The fill level plug is a hex head cap screw. It will be located between the Autovent and drain plug. Both types of plugs will have gaskets included to prevent oil from leaking.



Two types of plugs for maintenance

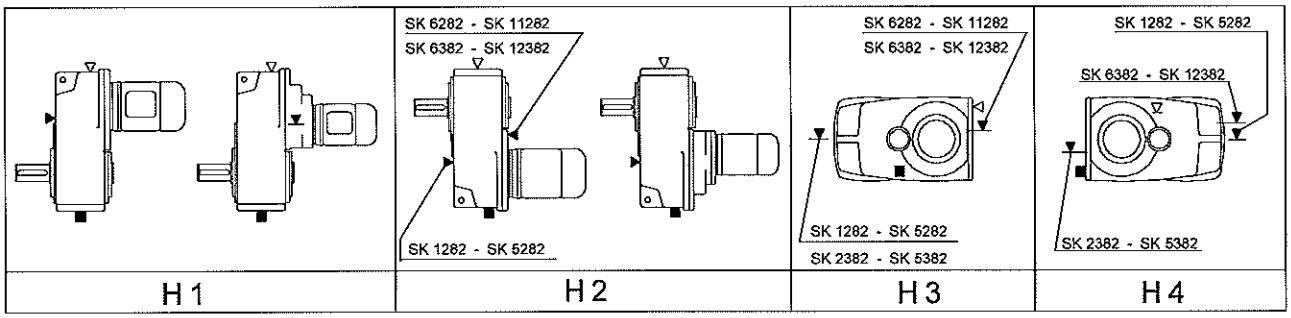
LUBRICANT
All NORD reducers are shipped from the factory properly filled with lubricant and all plugs are installed according to the mounting position given on the reducer nametag. Acceptable oil fill level is within ½ inch of the bottom of the fill plug threads.

OPERATION AND MAINTENANCE CHECKLIST
1. Operate the equipment as it was intended to be operated
2. Do not overload.
3. Run at correct speed.
4. Maintain lubricant in good condition and at proper level.
5. Dispose of used lubricant in accordance with applicable laws and regulations.
6. Apply proper maintenance to attached equipment at prescribed intervals recommended by the manufacturer.
7. Perform periodic maintenance of the gear drive as recommended by NORD.

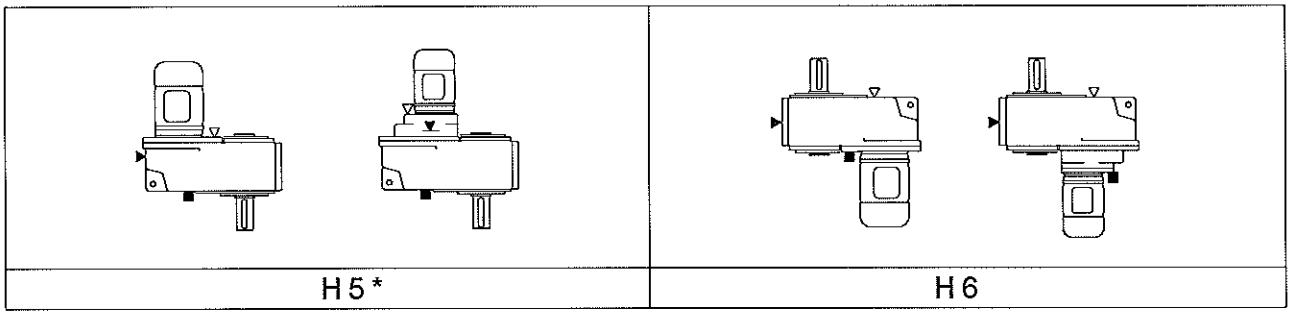
MOUNTING POSITIONS

These charts detail the mounting positions for horizontal and vertical mounting. The Autovent, oil fill plug and drain plug are indicated on each mounting position picture. The factory set mounting position and plug locations match that shown on the gearbox nametag. For mounting orientations other than shown consult NORD Gear.

Horizontal position



Vertical position



Symbols: Vent plug Oil level Drain plug

* Mounting position H5 with lubricant expansion unit recommended

~~**SK0182NB & SK1382NB have no vent or drain plugs. They are filled with synthetic oil so the units are "Lubed for Life".**~~

MAINTENANCE

Mineral lubricant should be changed every 10,000 service hours or after two years. For synthetic oils, the lube should be changed every 20,000 service hours or after four years. In case of extreme operating (e.g. high humidity, aggressive environment or large temperature variations), shorter intervals between changes are recommended.

OIL SPECIFICATIONS

NORD supplies all reducers filled with oil from the factory. Consult the sticker adjacent to the fill plug to determine the type of lubricant installed at the factory. Standard lubricant is ISO VG220 mineral-based oil. However, some units have special lubricants designed to operate in certain environments or to extend the service life of the lubricant. If in doubt about which lubricant is needed, contact NORD Gear.

STANDARD OIL – ISO VG220

Ambient Temperature	Formulation
20 to 104°F (-5 to 40°C)	Mineral

TYPICAL OILS

Viscosity ISO NLGI	Formulation	Service Temperature Range	Mobil	Shell	Castrol	Klüber Lubrication	bp	Tribol
VG 460	Conventional Mineral	20°C to +50°C 68F to +122°F	Mobilgear 634	Omala 460	7EP	Klüberoil GEM 1-460	Energol GR-XP 460	Tribol 1100/460
	Synthetic PAO	-30°C to +80°C -22°F to +176°F	Mobil SHC 634	Omala 460 HD	Isolube EP 460	Klübersynth EG 4-460	N/A	Tribol 1510/460
VG 320	Conventional Mineral	0°C to +30°C 32°F to +86°F	Mobilgear 632	Omala 320	6EP	Klüberoil GEM 1-320	Energol GR-XP 320	Tribol 1100/320
	Synthetic PAO	-35°C to +80°C -31°F to +176°F	Mobil SHC 632	Omala 320 HD	Isolube EP 460	Klübersynth EG 4-320	N/A	Tribol 1510/320
VG 220	Conventional Mineral	-5°C to +40°C +20°F to +104°F	Mobilgear 630	Omala 220	5EP	Klüberoil GEM 1-220	Energol GR-XP 220	Tribol 1100/220
	Synthetic PAO	-34°C to +80°C -30°F to +176°F	Mobil SHC 630	Omala 220 HD	Isolube EP 220	Klübersynth EG 4-220	N/A	Tribol 1510/220
VG 150 & VG 100	Conventional Mineral	-15°C to +25°C 5°F to +77°F	Mobilgear 629	Omala 100	4EP	Klüberoil GEM 1-150	Energol GR-XP 100	Tribol 1100/100
	Synthetic PAO	-37°C to +10°C -35°F to +50°F	Mobil SHC 629	Omala 150 HD	Isolube EP 150	Klübersynth EG 4-150	N/A	N/A
VG 68	Conventional Mineral	-15°C to +25°C 5°F to +77F	Mobilgear 626	Omala 68	2EP	Klüberoil GEM 1-68	Energol GR-XP 68	Tribol 1100/68
	Synthetic PAO	-40°C to +10°C -40°F to +50F	Mobil SHC 626	N/A	Isolube EP 68	N/A	N/A	N/A
VG 32	Synthetic PAO	-40°C to +10°C -40°F to +50°F	Mobil SHC 624	N/A	N/A	Klüber-Summit HySyn FG-32	N/A	N/A

PAO = Poly Alpha Olefin

SPECIAL PURPOSE LUBRICANTS

Ambient Temperature	Formulation	Manufacturer	Oil Brand Name
20 to 104°F (-5 to 40°C)	*Food Grade* Oil - Synthetic	Chevron	FM ISO 220
20 to 104°F (-5 to 40°C)	*Food Grade* Oil - Synthetic	OilJAX	Magnaplate 85W140-FG
5 to 125°F (-20 to 50°C)	Fluid Grease	Mobil	Mobilux EP023
-30 to 140°F (-35 to 60°C)	Fluid Grease - Synthetic	Mobil	Mobilith SHC 007
-30 to 140°F (-35 to 60°C)	Fluid Grease - Synthetic	Shell	Albida LC

STANDARD BEARING GREASE – NLGI 2EP Lithium

Ambient Temperature	Formulation
-20 to 140°F (-30 to 60°C)	Mineral

OPTIONAL BEARING GREASES

Ambient Temperature	Formulation	Manufacturer	Grease Brand Name
-40 to 230°F (-40 to 110°C)	Synthetic	Shell	Aeroshell 6
-40 to 230°F (-40 to 110°C)	*Food Grade* - Synthetic	Lubriplate	SFL1

LUBRICANT CAPACITY

Each reducer has the oil level and oil quantity adjusted according to the mounting position shown in the tables. When replacing the oil, consult the tables below to determine the proper amount of oil to be installed according to the reducer size and mounting position. Note that this is approximate and the final level will be adjusted when the reducer is installed. Acceptable oil fill level is within ½ inch of the bottom of the fill plug threads.

LUBRICATION CAPACITY - SHAFT MOUNT 'CLINCHER' GEARBOXES

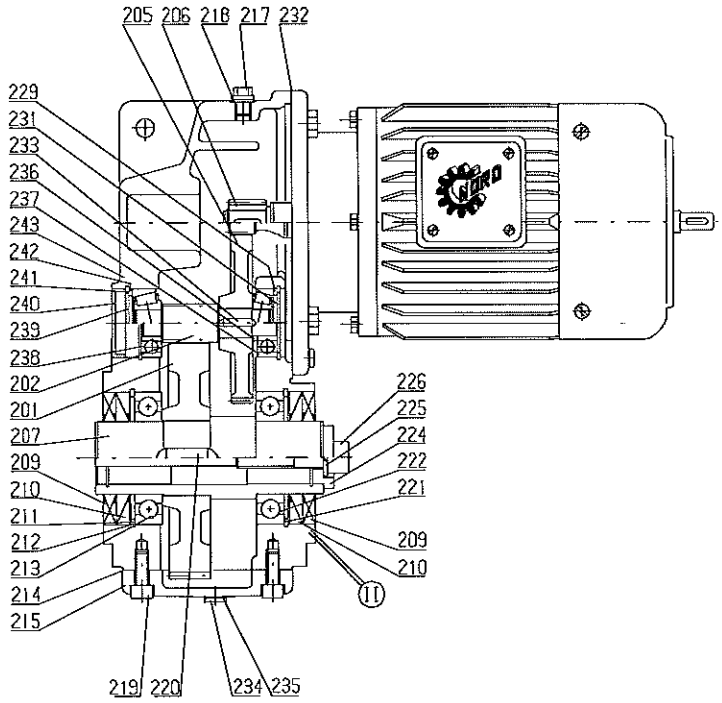
		MOUNTING POSITION					
		Horizontal				*Vertical*	
		H1	H2	H3	H4	H5	H6
SK 0182NB	quarts	0.42	0.63	0.53	0.53	0.58	0.58
	liters	0.40	0.60	0.50	0.50	0.55	0.55
SK0282NB	quarts	0.74	0.85	0.95	0.95	1.16	1.06
	liters	0.70	0.80	0.90	0.90	1.10	1.00
SK 1282	quarts	0.95	0.95	1.00	1.00	1.27	1.37
	liters	0.90	0.90	0.95	0.95	1.20	1.30
SK 2282	quarts	1.74	2.01	1.90	1.90	2.11	2.54
	liters	1.65	1.90	1.80	1.80	2.00	2.40
SK 3282	quarts	3.33	3.44	3.33	3.33	4.33	4.33
	liters	3.15	3.25	3.15	3.15	4.10	4.10
SK 4282	quarts	4.97	5.02	4.97	4.97	5.71	6.45
	liters	4.70	4.75	4.70	4.70	5.40	6.10
SK 5282	quarts	7.93	7.93	7.61	7.61	9.30	9.30
	liters	7.50	7.50	7.20	7.20	8.80	8.80
SK 6282	quarts	18.0	12.7	14.8	10.6	18.5	14.8
	liters	17.0	12.0	14.0	10.0	17.5	14.0
SK 7282	quarts	26.4	21.1	22.2	16.9	28.5	22.2
	liters	25	20	21	16	27	21
SK 8282	quarts	39.1	31.7	32.8	32.8	43.3	34.9
	liters	37	30	31	31	41	33
SK 9282	quarts	78.2	58.1	62.4	72.9	76.1	74.0
	liters	74	55	59	69	72	70
SK 10282	quarts	95	42	87	63	95	95
	liters	90	40	82	60	90	90
SK 11282	quarts	174	153	148	106	206	169
	liters	165	145	140	100	195	160

		MOUNTING POSITION					
		Horizontal				*Vertical*	
		H1	H2	H3	H4	H5	H6
SK 1382NB	quarts	1.37	1.48	2.01	2.11	2.22	2.43
	liters	1.30	1.40	1.90	2.00	2.10	2.30
SK 2382	quarts	1.80	2.01	1.59	1.59	3.28	2.75
	liters	1.70	1.90	1.50	1.50	3.10	2.60
SK 3382	quarts	4.33	3.49	3.49	3.49	5.92	4.33
	liters	4.10	3.30	3.30	3.30	5.60	4.10
SK 4382	quarts	6.24	5.18	5.18	5.18	8.77	7.19
	liters	5.90	4.90	4.90	4.90	8.30	6.80
SK 5382	quarts	13.21	7.08	8.77	8.77	14.80	12.68
	liters	12.50	6.70	8.30	8.30	14.00	12.00
SK 6382	quarts	17.4	10.1	13.2	14.8	19.0	13.7
	liters	16.5	9.6	12.5	14.0	18.0	13.0
SK 7382	quarts	23.3	16.9	20.1	24.3	26.4	21.1
	liters	22	16	19	23	25	20
SK 8382	quarts	35.9	26.4	31.7	37.0	40.2	33.8
	liters	34	25	30	35	38	32
SK 9382	quarts	77.2	47.6	63.4	68.7	78.2	74.0
	liters	73	45	60	65	74	70
SK 10382	quarts	90	77	85	85	93	93
	liters	85	73	80	80	88	88
SK 11382	quarts	169	148	143	164	222	164
	liters	160	140	135	155	210	155
SK 12382	quarts	169	148	143	164	222	164
	liters	160	140	135	155	210	155

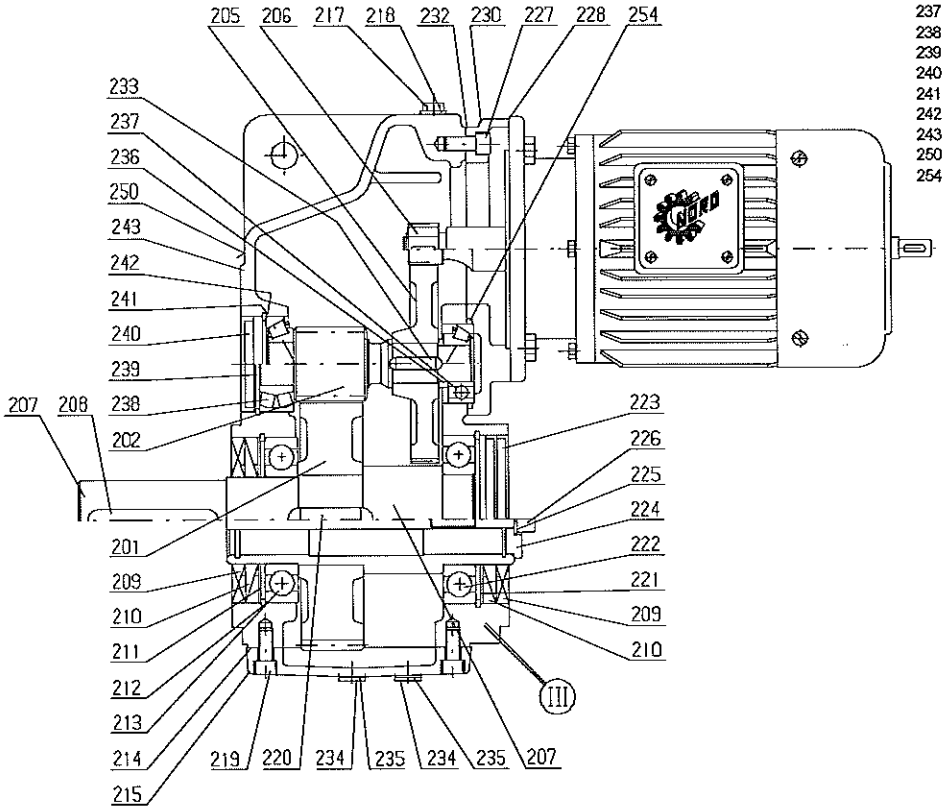
Note: Filling quantities are approximate figures. Oil level must be checked according to oil level plug after final installtion.
Acceptable oil fill level is within 1/2 inch of the bottom of the fill plug threads. For mounting angles not shown, consult factory.

PARTS LIST

SK1282 - SK5282



SK6282 - SK11282



201 Driven gear
202 Pinion shaft
205 Driving gear
206 Driving pinion
207 Output shaft (Hollow shaft)
208 Key
209 Shaft seal
210 Shaft seal
211 Circlip
212 Shim
213 Ball bearing
214 Seal
215 Gear case cover
217 Vent plug
218 Seal
219 Socket head screw
220 Key
221 Circlip
222 Ball bearing
223 Locking cap
224 Washer
225 Washer
226 Socket head screw
227 Socket head screw
228 Seal
229 Supporting disc
230 Gearbox cover
231 Circlip
232 Seal
233 Key
234 Drain plug
235 Seal
236 Supporting disc
237 Pinion shaft bearing
238 Pinion shaft bearing
239 Circlip
240 Locking cap
241 Shim
242 Supporting disc
243 Gear case
250 Locking cap
254 Spacer

RECOMMENDED SPARE PARTS

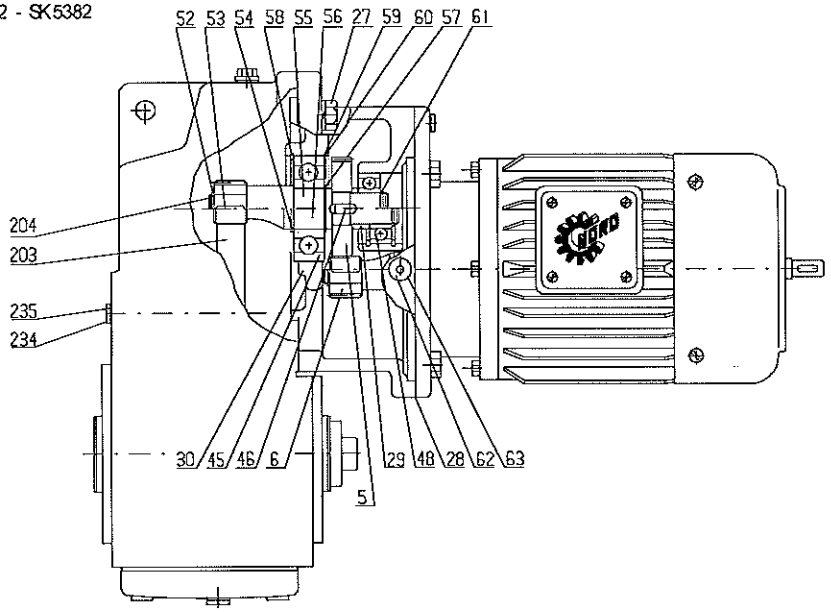
Bearings – *all* Gaskets – *all* Shims – *all*
Seals – *all* Seal Plugs – *all*

IMPORTANT!

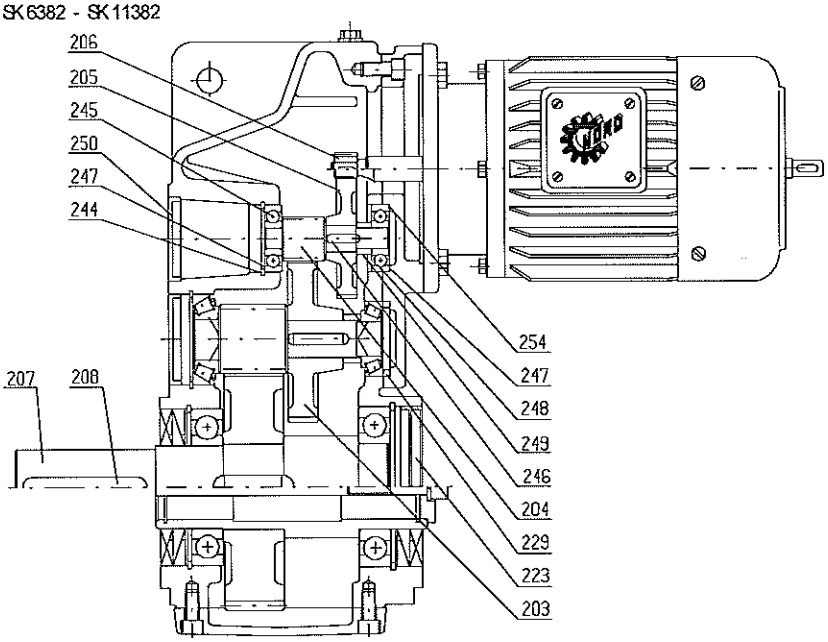
When ordering parts, it is necessary to have the ***NORD SERIAL NUMBER*** from the unit the parts are for. The serial number will dictate the correct parts for that particular unit. The gearbox nameplate will have the serial number on it.

PARTS LIST

SK1382 - SK5382



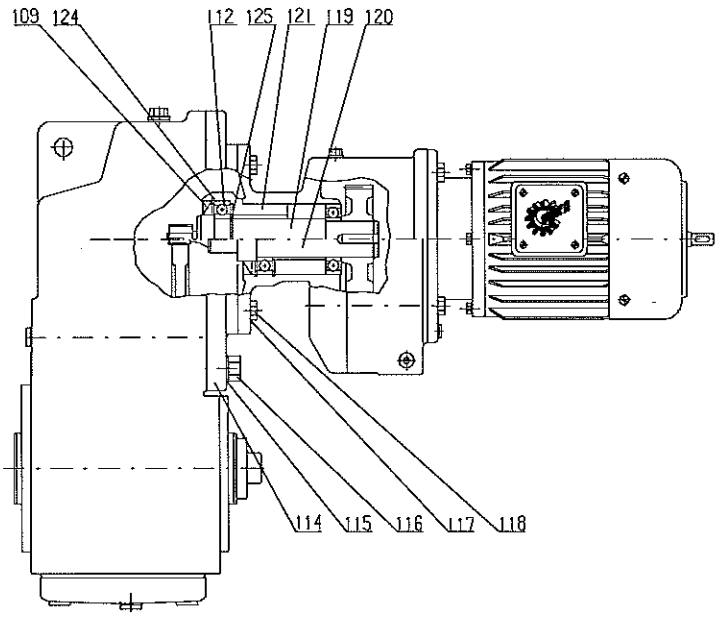
SK6382 - SK11382



5	Driving gear
27	Hexagon screw
28	Seal
29	Supporting disc
30	Third reduction gearcase
45	Ball bearing
46	Key
48	Ball bearing
52	Circlip
53	Key
54	Circlip
55	Intermediate shaft, plain
56	Intermediate shaft, gearcut
57	Circlip
58	Circlip
59	Shim
60	Circlip
61	Circlip
62	Drain plug
63	Seal
203	Driving gea
204	Pinion shaft SK6382 - SK9382
206	Driving pinion
207	Output shaft
208	Key
223	Locking cap
229	Supporting disc
234	Drain plug
235	Seal
244	Circlip
245	Ball bearing
246	Key
247	Shim
248	Ball bearing
249	Supporting disc
250	Locking cap
254	Spacer

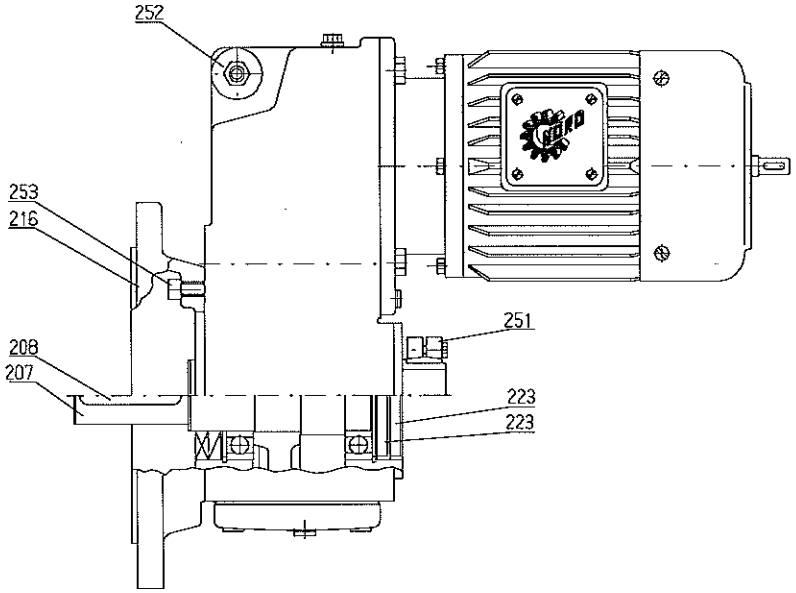
PARTS LIST

SK1282/02 - SK11382/52



109 Shaft seal
112 Ball bearing
114 Intermediate flange
115 Washer
116 Hexagon screw
117 Washer
118 Hexagon screw
119 Intermediate shaft, plain
120 Intermediate shaft, gearcut
121 Bearing sleeve
124 Circlip
125 Circlip
207 Output shaft
208 Key
216 Flange
223 Locking cap
251 Shrink disc connector
252 Torque arm
253 Socket head screw

SK1282 - SK11282
SK1382 - SK11382



TROUBLE SHOOTING

PROBLEM WITH THE REDUCER		POSSIBLE CAUSES	SUGGESTED REMEDY
Runs Hot	Overloading	Load exceeds the capacity of the reducer	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce load
	Improper lubrication	Insufficient lubrication	Check lubricant level and adjust up to recommended levels
		Excessive lubrication	Check lubricant level and adjust down to recommended levels
		Wrong lubrication	Flush out and refill with correct lubricant as recommended
Runs Noisy	Loose foundation bolts	Weak mounting structure	Inspect mounting of reducer. Tighten loose bolts and/ or reinforce mounting and structure
		Loose hold down bolts	Tighten bolts
	Worn RV Disc	Overloading unit may result in damage to disc	Disassemble and replace disc. Recheck rated capacity of reducer.
	Failure of Bearings	May be due to lack of lubricant	Replace bearing. Clean and flush reducer and fill with recommended lubricant.
		Overload	Check rated capacity of reducer.
	Insufficient Lubricant	Level of lubricant in the reducer not properly maintained.	Check lubricant level and adjust to factory recommended level.
Output Shaft Does Not Turn	Internal parts are broken	Overloading of reducer can cause damage.	Replace broken parts. Check rated capacity of reducer.
		Key missing or sheared off on input shaft.	Replace key.
		Coupling loose or disconnected.	Properly align reducer and coupling. Tighten coupling.
Oil Leakage	Worn Seals	Caused by dirt or grit entering seal.	Replace seals. Autovent may be clogged. Replace or clean.
		Overfilled reducer.	Check lubricant level and adjust to recommended level.
		Autovent clogged.	Clean or replace, being sure to prevent any dirt from falling into the reducer.
		Improper mounting position, such as wall or ceiling mount of horizontal reducer.	Check mounting position. Name tag & verify with mounting chart in manual.

NORD Gear Corporation
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Toll Free in Canada 800-668-4378

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Phone 951-279-2600
Fax 888-408-6673

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PO Box 367
800 Nord Drive
Waunakee, WI 53597
Phone 608-849-7300
Fax 800-373-6673

SOUTH
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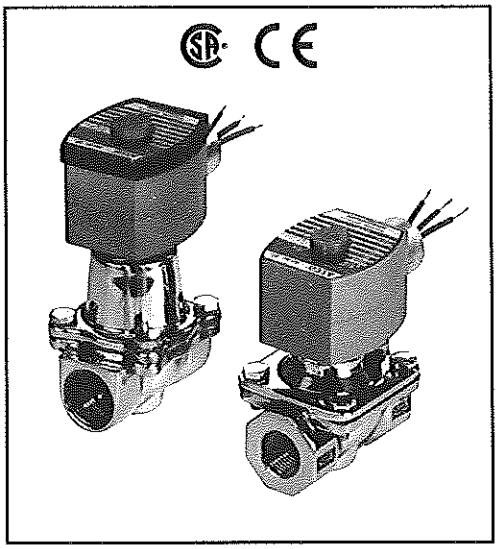
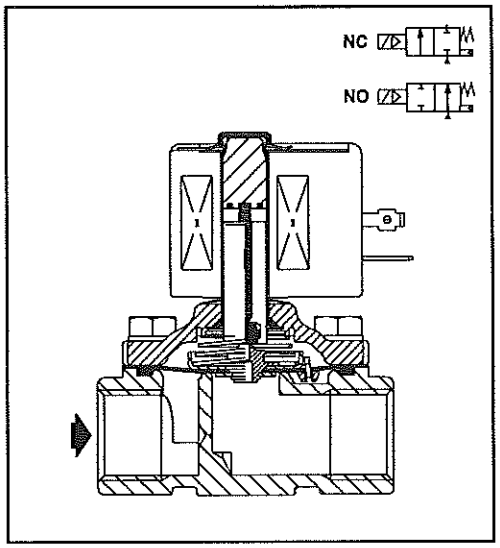
Building 100B
Charlotte, NC 28273
Phone 704-529-1255
Fax 888-259-6673

CANADA
41 West Drive
Brampton, Ontario L6T 4A1
Phone 905-796-3606
Fax 905-796-8130

Features

- Wide range of pressure ratings, sizes, and resilient materials provide long service life and low internal leakage
- High Flow Valves for liquid, corrosive, and air/inert gas service
- Industrial applications include:
  - Car wash
  - Laundry equipment
  - Air compressors
  - Industrial water control
  - Pumps





Construction

Valve Parts In Contact with Fluids		
Body	Brass	304 Stainless Steel
Seals and Discs	NBR or PTFE	
Disc-Holder	PA	
Core Tube	305 Stainless Steel	
Core and Plugnut	430F Stainless Steel	
Springs	302 Stainless Steel	
Shading Coil	Copper	Silver

Electrical

Standard Coil and Class of Insulation	Watt Rating and Power Consumption				Spare Coil Part Number			
		AC			General Purpose		Explosionproof	
	DC Watts	Watts	VA Holding	VA Inrush	AC	DC	AC	DC
F	-	6.1	16	40	238210	-	238214	-
F	11.6	10.1	25	70	238610	238710	238614	238714
F	16.8	16.1	35	180	272610	97617	272614	97617
F	-	17.1	40	93	238610	-	238614	-
F	-	20	43	240	99257	-	99257	-
F	-	20.1	48	240	272610	-	272614	-
H	30.6	-	-	-	-	74073	-	74073
H	40.6	-	-	-	-	238910	-	238914

Standard Voltages: 24, 120, 240, 480 volts AC, 60 Hz (or 110, 220 volts AC, 50 Hz). 6, 12, 24, 120, 240 volts DC. Must be specified when ordering.
Other voltages available when required.

Solenoid Enclosures

Standard: RedHat II - Watertight, Types 1, 2, 3, 3S, 4, and 4X; RedHat - Type I.

Optional: RedHat II - Explosionproof and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7, and 9; Red-Hat - Explosionproof and Watertight, Types 3, 4, 4X, 7, and 9.

(To order, add prefix "EF" to catalog number, except Catalog Numbers 8210B057, 8210B058, and 8210B059, which are not available with Explosionproof enclosures.)
See Optional Features Section for other available options.

Nominal Ambient Temp. Ranges

RedHat II/
RedHat AC: 32°F to 125°F (0°C to 52°C)

RedHat II DC: 32°F to 104°F (0°C to 40°C)
RedHat DC: 32°F to 77°F (0°C to 25°C)
(104°F/40°C occasionally)

Refer to Engineering Section for details.

Approvals

CSA certified. RedHat II meets applicable CE directives.
Refer to Engineering Section for details.

ASCO®

Specifications (English units)

Pipe Size (ins.)	Orifice Size (ins.)	Cv Flow Factor	Operating Pressure Differential (psi) Min.	Max. AC Air-Inert Gas	Max. AC Water	Max. AC Light Oil @ 300 SSU	Max. DC Air-Inert Gas	Max. DC Water	Max. DC Light Oil @ 300 SSU	Max. Fluid Temp. °F AC	Max. Fluid Temp. °F DC	Brass Body Catalog Number	Brass Body Const. Ref. ④	Brass Body UL ⑤ Listing	Stainless Steel Body Catalog Number	Stainless Steel Body Const. Ref. ④	Stainless Steel Body UL ⑤ Listing	Watt Rating/ Class of Coil Insulation ⑦ AC	Watt Rating/ Class of Coil Insulation ⑦ DC
NORMALLY CLOSED (Closed when de-energized), NBR or PTFE ② Seating																			
3/8	3/8	1.5	①	150	125	-	40	40	-	180	150	8210G073 ③	1P	●	8210G036 ③	1P	●	6.1/F	11.6/F
3/8	5/8	3	0	150	150	-	40	40	-	180	150	8210G002	5D	○	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	200	150	135	125	100	100	180	150	8210G001	6D	○	-	-	-	6.1/F	11.6/F
3/8	5/8	3	5	300	300	300	-	-	-	175	-	8210G006	5D	○	-	-	-	17.1/F	-
1/2	7/16	2.2	①	150	125	-	40	40	-	180	150	8210G015 ③	2P	●	8210G037 ③	2P	●	6.1/F	11.6/F
1/2	5/8	4	0	150	150	-	40	40	-	180	150	8210G094	5D	○	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	40	40	-	175	150	-	-	-	8210G087	7D	●	17.1/F	11.6/F
1/2	5/8	4	5	200	150	135	125	100	100	180	150	8210G002	6D	○	-	-	-	6.1/F	11.6/F
1/2	5/8	4	5	300	300	300	-	-	-	175	-	8210G007	5D	○	-	-	-	17.1/F	-
1/2	3/4	4	5	-	300	-	-	300	-	180	125	8210G227	5D	○	-	-	-	17.1/F	40.6/H
3/4	5/8	4.5	0	150	150	125	40	40	-	175	150	-	-	-	8210G088	7D	●	17.1/F	11.6/F
3/4	3/4	5	5	125	125	125	100	90	75	180	150	8210G009	9D	○	-	-	-	6.1/F	11.6/F
3/4	3/4	5	0	150	150	-	40	40	-	180	150	8210G095	8D	○	-	-	-	10.1/F	11.6/F
3/4	3/4	6.5	5	250	150	100	125	125	125	180	150	8210G003	11D	○	-	-	-	6.1/F	11.6/F
3/4	3/4	6	0	-	-	-	200	180	180	-	77	8210B026 ② ‡	10P	-	-	-	-	-	30.6/H
3/4	3/4	6	0	350	300	200	-	-	-	200	-	8210G026 ② ‡	40P	●	-	-	-	16.1F	-
1	1	13	0	-	-	-	100	100	80	-	77	8210B054 ‡	31D	-	8210D089	15D	-	-	30.6/H
1	1	13	0	150	125	125	-	-	-	180	-	8210G054	41D	●	8210G089	45D	●	16.1/F	-
1	1	13	5	150	150	100	125	125	125	180	150	8210G004	12D	○	-	-	-	6.1/F	11.6/F
1	1	13.5	0	300	225	115	-	-	-	200	-	8210G027 ‡	42P	●	-	-	-	20.1/F	-
1	1	13.5	10	300	300	300	-	-	-	175	-	8210G078 ②	13P	-	-	-	-	17.1/F	-
1 1/4	1 1/8	15	0	-	-	-	100	100	80	-	77	8210B055 ‡	32D	-	-	-	-	-	30.6/H
1 1/4	1 1/8	15	0	150	125	125	-	-	-	180	-	8210G055	43D	●	-	-	-	16.1/F	-
1 1/4	1 1/8	15	5	150	150	100	125	125	125	180	150	8210G008	16D	○	-	-	-	6.1/F	11.6/F
1 1/2	1 1/4	22.5	0	-	-	-	100	100	80	-	77	8210B056 ‡	33D	-	-	-	-	-	30.6/H
1 1/2	1 1/4	22.5	0	150	125	125	-	-	-	180	-	8210G056	44D	●	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	5	150	150	100	125	125	125	180	150	8210G022	18D	●	-	-	-	6.1/F	11.6/F
2	1 3/4	43	5	150	125	90	50	50	50	180	150	8210G100	20P	●	-	-	-	6.1/F	11.6/F
2 1/2	1 3/4	45	5	150	125	90	50	50	50	180	150	8210G101	21P	●	-	-	-	6.1/F	11.6/F
NORMALLY OPEN (Open when de-energized), NBR Seating (PA Disc-Holder, except as noted)																			
3/8	5/8	3	0	150	150	125	125	125	80	180	150	8210G033	23D	●	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	250	200	200	250	200	200	180	180	8210G011 ⑥ ⑨	39D	●	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	125	125	80	180	150	8210G034	23D	●	-	-	-	10.1/F	11.6/F
1/2	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G030	37D	●	10.1/F	11.6/F
1/2	5/8	4	5	250	200	200	250	200	200	180	180	8210G012 ② ⑥	39D	●	-	-	-	10.1/F	11.6/F
3/4	3/4	5.5	0	150	150	125	125	125	80	180	150	8210G035	25D	●	-	-	-	10.1/F	11.6/F
3/4	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G038	38D	●	10.1/F	11.6/F
3/4	3/4	6.5	5	-	-	-	250	200	200	-	180	8210C013	24D	●	-	-	-	-	16.8/F
3/4	3/4	6.5	5	250	200	200	-	-	-	180	-	8210G013	46D	●	-	-	-	16.1/F	-
1	1	13	0	125	125	125	-	-	-	180	-	8210B057 ⑥ ⑨	34D	●	-	-	-	20/F	-
1	1	13	5	-	-	-	125	125	125	-	180	8210D014	26D	●	-	-	-	-	16.8/F
1	1	13	5	150	150	125	-	-	-	180	-	8210G014	47D	●	-	-	-	16.1/F	-
1 1/4	1 1/8	15	0	125	125	125	-	-	-	180	-	8210B058 ⑥ ⑨	35D	●	-	-	-	20/F	-
1 1/4	1 1/8	15	5	-	-	-	125	125	125	-	180	8210D018	28D	●	-	-	-	-	16.8/F
1 1/4	1 1/8	15	5	150	150	125	-	-	-	180	-	8210G018	48D	●	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	0	125	125	125	-	-	-	180	-	8210B059 ⑥ ⑨	36D	●	-	-	-	20/F	-
1 1/2	1 1/4	22.5	5	-	-	-	125	125	125	-	180	8210D032	29D	●	-	-	-	-	16.8/F
1 1/2	1 1/4	22.5	5	150	150	125	-	-	-	180	-	8210G032	49D	●	-	-	-	16.1/F	-
2	1 3/4	43	5	-	-	-	125	125	125	-	150	8210 103	30P	●	-	-	-	-	16.8/F
2	1 3/4	43	5	125	125	125	-	-	-	180	-	8210G103	50P	●	-	-	-	16.1/F	-
2 1/2	1 3/4	45	5	-	-	-	125	125	125	-	150	8210 104	27P	●	-	-	-	-	16.8/F
2 1/2	1 3/4	45	5	125	125	125	-	-	-	180	-	8210G104	51P	●	-			16.1/F	-

① 5 psi on Air; 1 psi on Water.
② Valve provided with PTFE main disc.
③ Valve includes Ultem (G.E. trademark) piston.
④ Letter "D" denotes diaphragm construction; "P" denotes piston construction.
⑤ ○ Safety Shutoff Valve; ● General Purpose Valve.
Refer to Engineering Section (Approvals) for details.
⑥ Valves not available with Explosionproof enclosures.
⑦ On 50 hertz service, the watt rating for the 6.1/F solenoid is 8.1 watts.
⑧ AC construction also has PA seating.
⑨ No disc-holder.
⑩ Stainless steel disc-holder.
‡ Must have solenoid mounted vertical and upright.

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www.flsmidthkrebs.com

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

1 MODEL D10LB-S845-SDM KREBS CYCLONE
SERIAL NUMBER: 132884U

KREBS SDM MANUAL

KREBS ENGINEERS

General

For more than 50 years KREBS ENGINEERS has been concerned with the development and application of liquid cyclones in virtually all industries requiring the separation of solids from liquids. KREBS' management has emphasized the building of a trained engineering staff so clients in all parts of the world can be assured of prompt technical recommendations with respect to cyclone selection, installation, operation and maintenance. An important service to our clients is the availability of parts from a very large inventory that permits early shipment of complete cyclones or cyclone parts. Prompt, efficient attention to our clients' needs is one of the most important goals in the operation of our company.

KREBS ENGINEERS is firmly dedicated to serving industry as a reliable supplier of liquid cyclones and as a provider of superior commercial and technical services.

Installation

Smaller units are crated and shipped completely assembled. Larger units are generally shipped dismantled as two pieces in order to reduce the size of the shipping crate. Component parts, such as pipe fittings and spare parts, are frequently placed inside the cone section. Be sure to account for all parts, checking them against the packing slip, when removing the cyclone from the shipping crate.

Cyclone

The feed is introduced into the cyclone through a special involuted design that pre-classifies material prior to entering the feed chamber. A centrifugal force is established when the slurry enters the feed chamber and "spins out " the grit, forcing it to discharge through the apex orifice along with some liquid. The remaining liquid, and lighter solids, are discharged out the overflow pipe.

Different types of standard feed orientations are shown on Drawing SK847. Positions H-1 and H-2 are for horizontal feed piping and positions V-1 and V-2 are for vertical feed piping. All orientations are acceptable and they all minimize connections for contractor installation. Custom mounting can be supplied if required.

Angle of Installation

The cyclone is normally installed with the axis of the cyclone at an angle of 11¼ degrees from the horizontal for most sewage degritting applications. The general arrangement drawings contained in this manual show the cyclones in a vertical position, for convenience only, but they should be installed 11 ¼ degrees from the horizontal. There are two main reasons for this, indicated as follows:

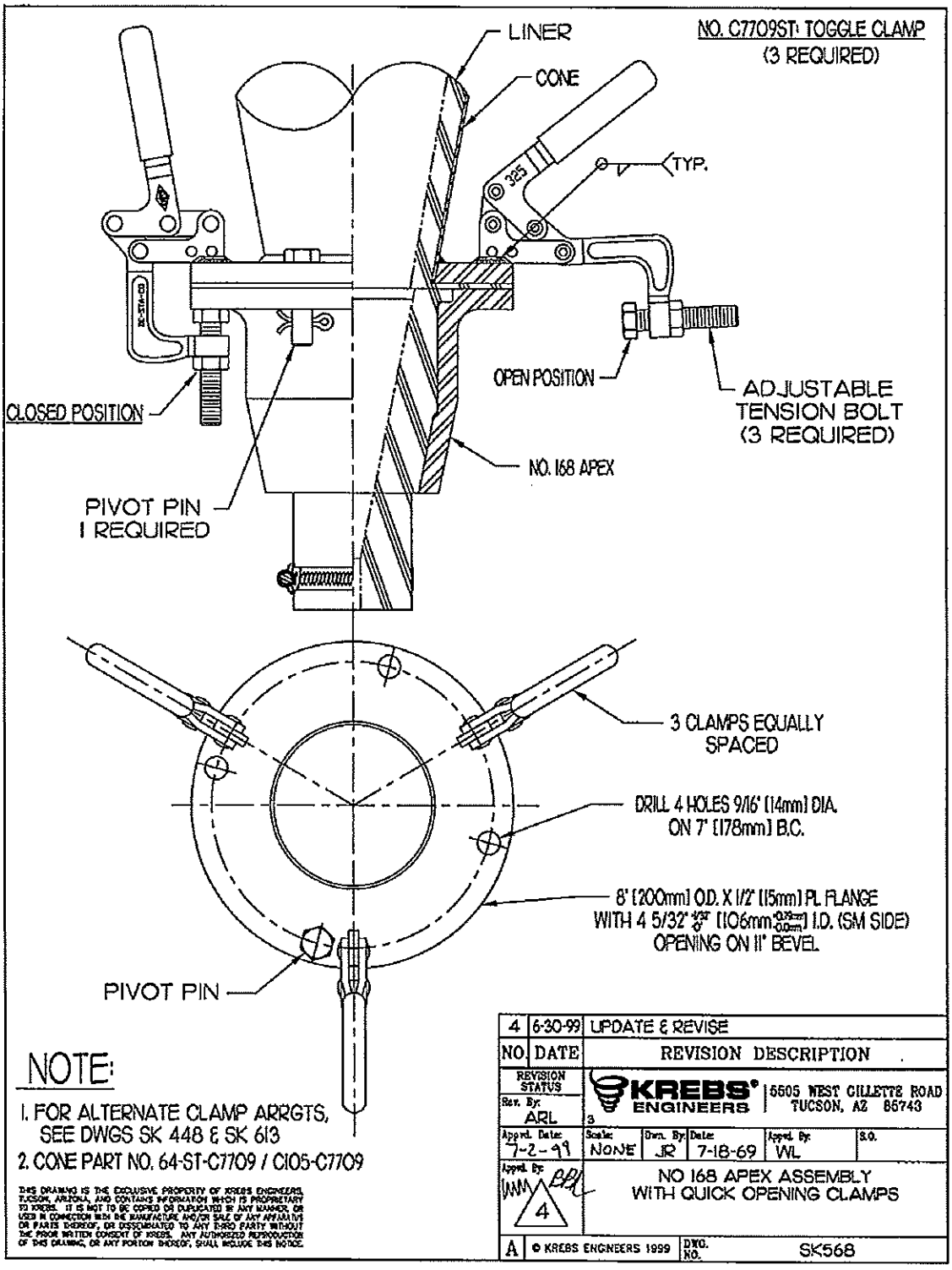
1. In a nearly horizontal position, the amount of liquid being discharged with the grit is minimized, therefore resulting in more efficient performance.

2. The reduction of liquid flow permits larger apex orifices and minimizes plugging.

Grit Discharge Point

The apex, the point where the grit discharges, should be enclosed in a box-type arrangement that allows the operator to observe the grit as it discharges normally.

In the case of an apex blockage, due to unusually large material, each unit is supplied with three quick-opening toggle clamps (see Sketch SK568 or SK1872) in order to remove the apex assembly for cleaning. The blockage can then be cleared without any special tools. The apex itself is adjustable by the means of a hose clamp. Both pneumatic/hydraulic adjustable apexes and fixed apexes are available upon special request.



NOTE:

1. FOR ALTERNATE CLAMP ARRGTS, SEE DWGS SK 448 & SK 613
2. CONE PART NO. 64-ST-C7709 / C105-C7709

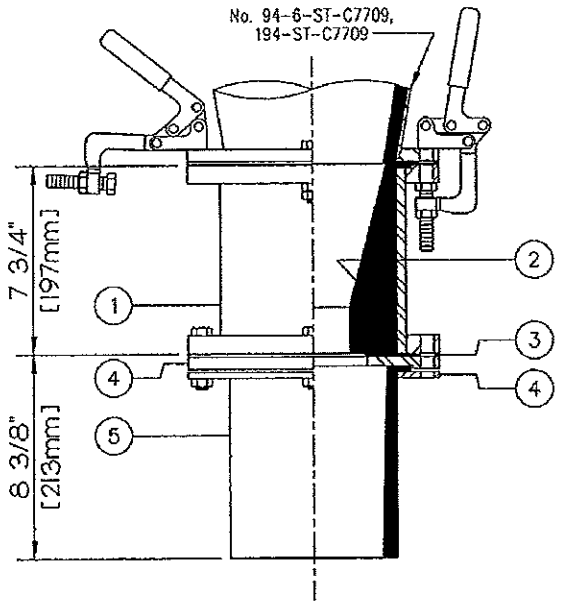
NO.	DATE	REVISION DESCRIPTION
4	6-30-99	UPDATE & REVISE

REVISION STATUS	KREBS® ENGINEERS				6565 WEST GILLETTE ROAD TUCSON, AZ 85743
Rev. By: ARL					
Appvd. Date: 7-2-99	Scale: NONE	Dwn. By: JR	Date: 7-18-69	Appvd. By: WL	S.O.
Appvd. By: BBL 4	NO 168 APEX ASSEMBLY WITH QUICK OPENING CLAMPS				
A	© KREBS ENGINEERS 1999	DWG. NO.	SK568		

KREBS ENGINEERS

SEWAGE DEGRITTING APEX

No. 668 FIXED ASSEMBLY



No. 668 PARTS LIST

	PART No.	DESCRIPTION
1	604-ST	APEX VALVE HOUSING, STEEL.
2	678R-(MOC)-(SIZE)	APEX VALVE LINER, ELASTOMER, SIZES AVAILABLE: 2", 2.25", 2.5", 2.75", 3", 3.25", 3.5", 3.75", 4", 4.25", 4.5", 4.75", 5", 5.25", 5.5", 5.75", 6".
3	C6047G-RN	GASKET, NEOPRENE.
4	669SPC-(MOC)-(SIZE)	APEX RETAINER PLATE, ROYAL CAST OR STEEL. SIZES AVAILABLE: 4", 4.5", 5", 6".
5	670-ST	SPLASH SKIRT RETAINER PLATE, STEEL
6	670R-(MOC)	SPLASH SKIRT, ELASTOMER.

NOTES:

1. SPECIFY PART NUMBER, MATERIAL & CYCLONE SERIAL NUMBER WHEN ORDERING PARTS.
2. STANDARD LINER MATERIAL: BPC RUBBER OR NEOPRENE -OTHER MATERIALS AVAILABLE UPON REQUEST.
3. DIMENSIONS ARE APPROXIMATE & FOR REFERENCE ONLY.

NO.	DATE	REVISION DESCRIPTION
1	9-16-04	CORRECT APEX HOUSING PART NO.

REVISION STATUS
Rev. By: ADG 6
Appvd. Date: 9-16-04
Appvd. By: [signature] 1

KREBS® ENGINEERS | 5505 WEST GILLETTE ROAD TUCSON, AZ 85743

Scale:	Drn. By:	Date:	Appvd. By:	S.O.
----	ADG	9-15-04	SNP JDL	

SEWAGE DEGRITTING APEXES
NO. 668

A | © KREBS ENGINEERS 2004 | DWG. NO. SK1872

KREBS® ENGINEERS

Cyclone Mounting

Each cyclone is equipped with its own mounting frame. These frames vary, depending upon the type of cyclone, but are basically plates or angles perpendicular to the cyclone axis with four holes to providing anchor bolting to a frame that has been supplied by others. We recommend an additional tie-down type of U-bolt clamp, located near the apex assembly for the 15-inch and larger models, due to their increased size.

Inlet Piping

The cyclone inlet can be supplied with either 150 lb. connections or Victaulic flanges that meet specifications for both the ASA 150 lb. steel or 125 lb. cast iron flange standards. KREBS ENGINEERS recommends the Victaulic type connections as we feel the Victaulic fittings simplify connections in the field. By using a Victaulic flange the flange can be rotated to compensate for the 11¼ degree mounting, resulting in a typical horizontal connection that requires no special contractor piping.

The inlet also provides for the installation of a pressure gauge, with gauge protector, which has been supplied by KREBS ENGINEERS. Each cyclone inlet is tapped for a 0.25-inch or 1.25-inch NPT gauge connection. Install the diaphragm assembly first and then be sure to fill the upper chamber with any light machine oil before installing the gauge.

Overflow Piping

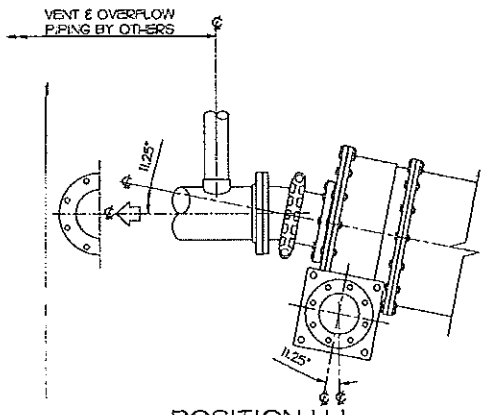
The cyclone overflow is equipped with a Victaulic coupling, Victaulic 11¼ degree elbow and Victaulic flange, similar to the inlet with the exception that it is a larger pipe size. These fittings also provide for a horizontal connection for the contractor.

One item that is not provided by KREBS ENGINEERS is a vent pipe or "siphon break" in the overflow piping. This is simply a vertical pipe of 1½ -inch or 2-inch size, approximately 2 feet long (see Sketch SK847). The vent pipe prevents grit from being siphoned into the overflow.

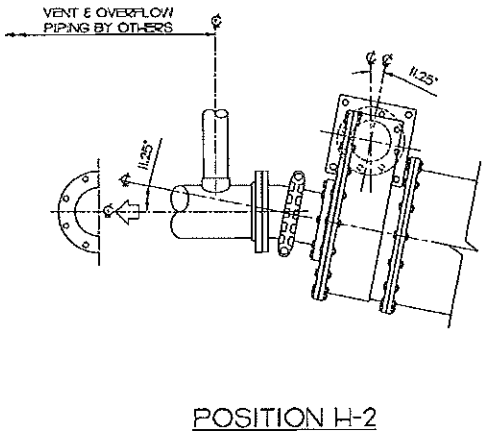
Design and Materials of Construction

The Krebs Cyclone is designed using a modular type construction of metal housings with replaceable liners. This allows great flexibility in offering different types of metal housings, to optimize both strength and weight, while also providing for the use of different types of lining material that is best suited for the application.

The housings are a combination of steel, which provides the strength for mounting and high-pressure areas, and aluminum in other areas to reduce weight. The standard lining material is high pressure, molded Neoprene but can also be natural gum or Hycar (Nitrile), as well as urethane or other elastomers, and ceramics.

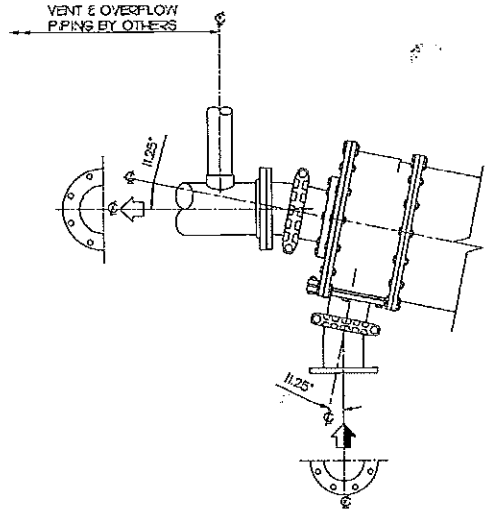


POSITION H-1

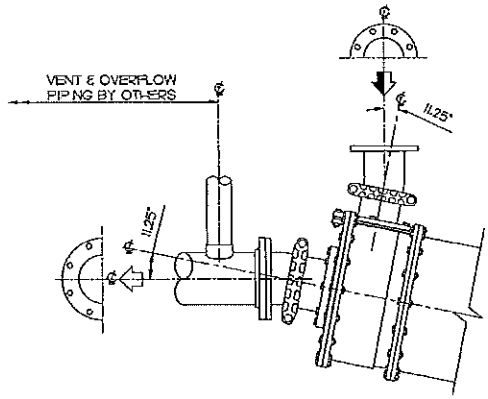


POSITION H-2

ARRANGEMENTS FOR HORIZONTAL FEED PIPING



POSITION V-1



POSITION V-2

ARRANGEMENTS FOR VERTICAL FEED PIPING

(ADDITIONAL VICTAULIC COUPLING & 11 1/4° ELBOW REQUIRED)

NO	DATE	REVISION DESCRIPTION
4	7-99	UPDATE TO AUTOCAD

REVISION STATUS
Drn. By: VC

KREBS ENGINEERS 6505 WEST GILLETTE ROAD TUCSON, AZ 85743

Date: 7/25/91	Scale: 1" = 1'	Drn. By: SAS	Date: 10-11-79	Appvd. By: JM	S.O.

Appvd. By:

4

FEED, OVERFLOW & VENT PIPING
LAYOUT FOR KREBS
SEWAGE DEGRITTING CYCLONES

C | © KREBS ENGINEERS 1999 | DWG. NO. SK847

KREBS ENGINEERS

Pumping

Pumping to a cyclone must be carefully engineered to the job, both as to size and type of pump and to size and length of pipe line. Wear results in a much higher pump maintenance cost than cyclone maintenance cost. Wear on a pump varies approximately as the cube of the speed and, in order to minimize pump speed and pump maintenance, the cyclone should be as close to the pump as possible. There are also power savings by having the static and friction head as low as possible. There is an economic advantage in buying a larger pump and running it at a lower speed. Efficiency will drop off slightly, when considered in terms of pumping clear water, but the reduction in wear will more than offset the loss of efficiency. The savings in maintenance costs can generally justify the more expensive larger pump, particularly when pumping abrasive slurries.

Pump Sump

Conversion of flow and velocity to kinetic energy in a cyclone is derived from the energy supplied by the pump. Each adjustment of the cyclone variables will influence the pumping to some degree. Constant volume to the cyclone is important. Momentary fluctuations are generally the result of entrained air in the slurry.

Correct design of the pump sump is probably the most important single factor in establishing an efficient cyclone operation. Many operators have assumed that a full pump sump is an indication that variations in the volume of pump discharge have been eliminated. All too frequently this is an erroneous conclusion as a vertical pipe line feeding the sump and pointing downward into the sump can carry entrained air to the bottom of the sump through a substantial depth of a slurry and create fluctuating pressure at the inlet of the cyclone. The level in the pump sump is by no means an indication the cyclone is receiving a constant and uniform volume of feed. This can best be detected by watching the inlet pressure gauge attached to the cyclone. If the needle of the gauge fluctuates fairly rapidly, it is a definite indication that there is entrained air in the pump discharge slurry, despite the fact that the pump sump may hold a constant level. The only way to correct this deficiency is to prevent the entering stream from carrying entrapped air to the suction of the pump. A simple correction is to mount a horizontal metal plate in the pump sump well below the normal level of the slurry in the sump. This plate can hang by straps, suspended from the top of the sump, or the plate can be welded at several points around the periphery of the sump to hold it in place. An annular opening between the plate and the edges of the sump of about 1" around its entire periphery will generally be sufficient to allow the total volume of slurry to pass from the upper compartment to the lower section.

It is always difficult to control the feed volume in any pumping circuit at an exact constant. It is always desirable to install a float valve connected to a fresh water supply in the pump sump to safeguard against the possibility of minor fluctuations in flow. This float can be adjusted so it only functions when the level in the sump is drawn down to a low level. This will prevent emptying the sump, which will cause a momentary air lock, and a sudden fluctuation in volume pumped.

In certain operations it is permissible to return a small portion of the overflow product to the pump sump to maintain a constant level. It must be remembered that the slime content in any feed slurry to a cyclone is an inhibiting factor that affects the separation. The greater the slime content, the more difficult it becomes to make a given separation for a given set of conditions of dilution and feed pressure. This is the reason that the use of re-circulated overflow product should be handled with caution, as there is always danger of re-circulating an excess quantity and unnecessarily increasing the slime content in the cyclone feed slurry. Where

water is reasonably plentiful and the volume of overflow product is not an important consideration, it is desirable to add fresh water as a means of volume control instead of re-circulating the overflow product from the cyclone.

Piping

The most important consideration, when designing cyclone piping, is to establish a velocity that will prevent particle segregation in the pipeline and at the same time hold the velocity to a minimum to reduce wear. Wear increases rapidly with increase in velocity. The velocity range falls between a low of about 5 feet per second to a high of 15 feet per second for a large majority of slurry pumping installations. Major factors in determining the optimum velocity in a pipeline are:

- ***particle size,***
- ***angularity of the coarser fractions,***
- ***specific gravity of solids,***
- ***slime content,***
- ***pulp density and***
- ***viscosity.***

Operation

The primary consideration in selecting the proper size and design of a cyclone is the classification objective, not capacity (as is the case in many other process devices). The staff at KREBS Engineers designs the proper relationship between inlet orifice, vortex finder and apex orifice size for each specific classification objective. All cyclones are engineered for the job prior to shipment. There is seldom any necessity for changing orifice sizes unless the classification objectives or plant operating conditions are altered.

Numerous factors influence the operation of a cyclone such as distribution of particle sizes, percent feed solids, specific gravity of solids and liquid and pulp viscosity. The following sections contain a brief discussion of some factors influencing cyclone operation the operator is normally able to vary:

Feed Dilution

Feed dilution is the most effective control available. The use of additional dilution water will always result in a finer and sharper separation.

Pressure Management

Pressure drop across a cyclone is the pressure differential between the cyclone inlet and overflow. When the cyclone discharges to atmosphere, a condition that we always recommend, the inlet pressure (gauge reading) is, for practical purposes, the pressure drop. The pressure drop and cyclone inlet pressure are synonymous in such cases. The terms are not synonymous where the cyclone overflow discharges against a head (back pressure against the cyclone overflow).

Pressure management is merely an indication of the energy required to force a given volume through a cyclone fitted with a certain combination of orifices and is not an indication of developed force-pattern or throughput, except as related to that one particular set of operating conditions. To cite an extreme example, it is entirely possible to operate with an abnormally high pressure drop across a cyclone fitted with small inlet, vortex, and apex orifice. The volume throughput could be very small whereas superior performance, as well as greatly increased capacity, could result from the same cyclone operating at a lower pressure drop with larger orifices. Excessive pressure results in high pump operating and maintenance costs and should be avoided wherever possible.

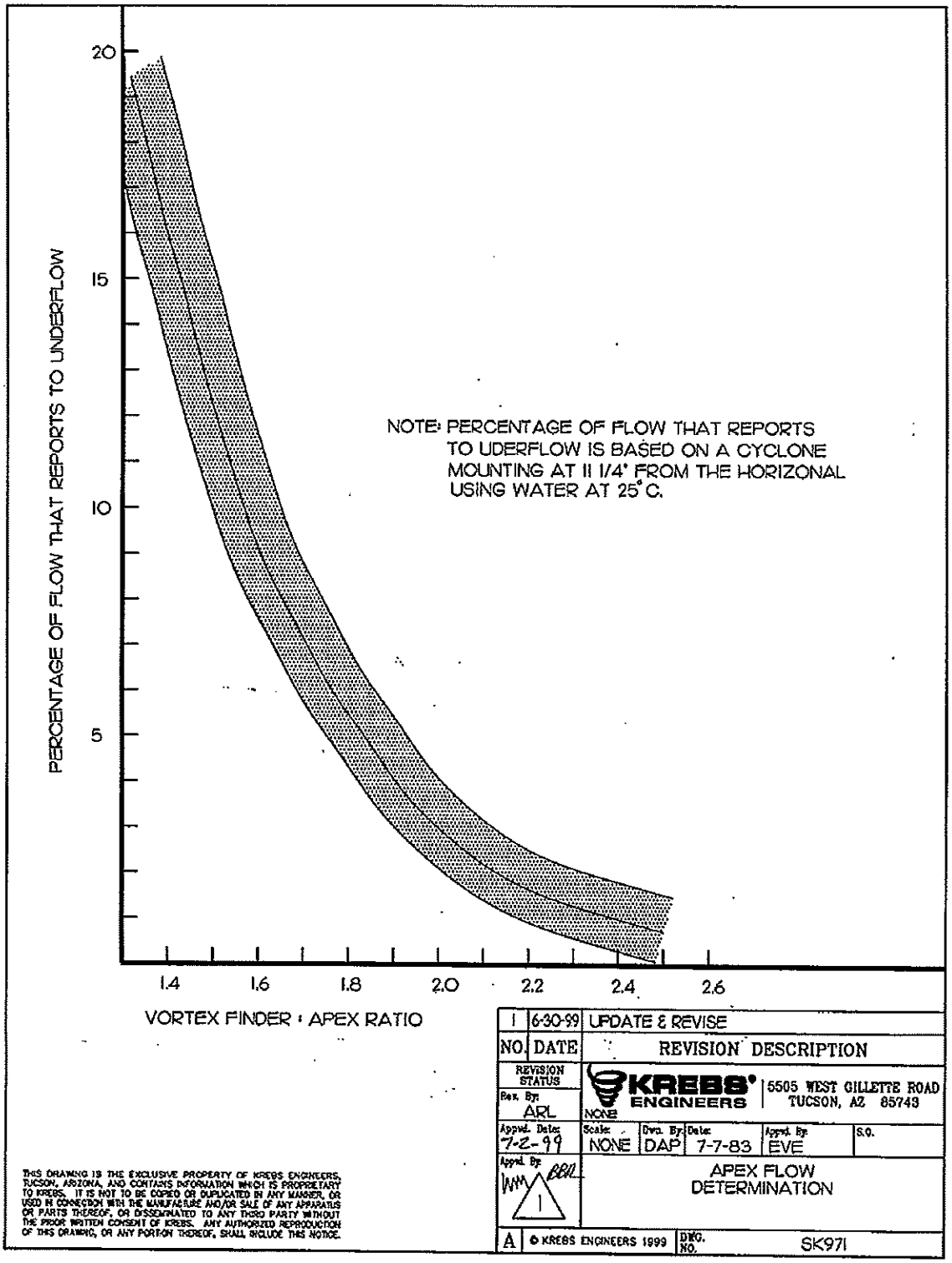
Capacity/Pressure Relationship

The capacity curves included with each cyclone model show the relationship between the flow rate and pressure drop. For all models there are several sizes of vortex finders, which are interchangeable within each unit. This feature allows the selection of the model necessary to maintain a pressure drop in the 6 to 12 psi range. This range is recommended for best performance and allows for efficient operation with relatively low energy consumption.

Apexes

Once the model of cyclone has been selected, along with its corresponding vortex finder, the percentage of feed flow that discharges from the apex can be determined from drawing SK971. For example, if the apex diameter is ½ of the vortex finder (vortex finder/apex ratio equals 2.0) approximately 3.0% of the feed flow will discharge from the apex orifice.

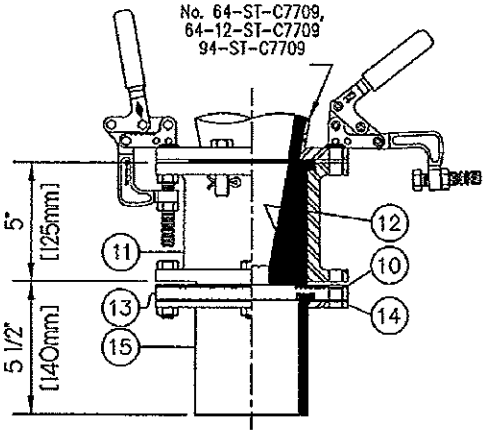
The different apex sizes available are shown on Drawings SK977 and SK1872 and come in either manually adjustable, pneumatically/hydraulically adjustable, or fixed. It is recommended that the minimum apex size be approximately 1.5 inches to minimize the risk of plugging, and as large as 2.0 inches if possible.



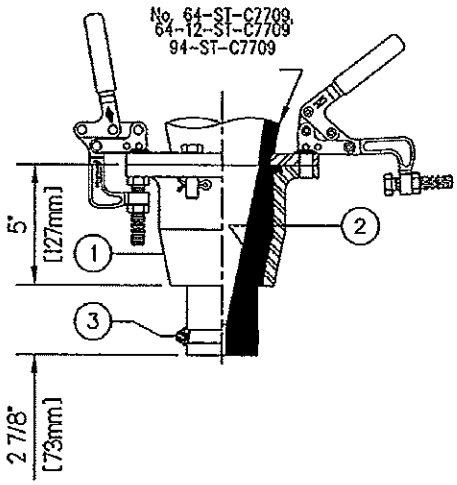
KREBS ENGINEERS

SEWAGE DEGRITTING APEXES

No. 368 FIXED ASSEMBLY



No. 168 ADJUSTABLE ASSEMBLY



No. 368 PARTS LIST

	PART No.	DESCRIPTION
10	370-RN	GASKET, NEOPRENE
11	368-(MOC)	APEX VALVE HOUSING ALUMINUM OR STEEL.
12	378R-(MOC)-(SIZE)	APEX VALVE LINER, ELASTOMER, SIZES AVAILABLE: .5", .625", .75", .875", 1", 1.125", 1.25", 1.5", 1.75", 2.", 2.25", 2.5", 2.75", 3."
13	369SP-CS	APEX RETAINER PLATE, CAST STEEL
14	370-ST	SPLASH SKIRT RETAINER PLATE,STEEL
15	370R-(MOC)	SPLASH SKIRT, ELASTOMER.

No. 168 PARTS LIST

	PART No.	DESCRIPTION
1	168-(MOC)	APEX VALVE HOUSING ALUMINUM OR STEEL.
2	68R-MOC-(SIZE)	APEX VALVE LINER, ELASTOMER, SIZES AVAILABLE: .375", .5", .625", .75", .875", 1", 1.25", 1.375", 1.5", 1.625", 1.75", 2", 2.25" & 2.5".
3	C7716-SS	HOSE CLAMP (WORM DRIVE), STAINLESS STEEL.

NOTES:

1. SPECIFY PART NUMBER, MATERIAL & CYCLONE SERIAL NUMBER WHEN ORDERING PARTS.
2. STANDARD LINER MATERIAL: BPC RUBBER OR NEOPRENE -OTHER MATERIALS AVAILABLE UPON REQUEST.
3. DIMENSIONS ARE APPROXIMATE & FOR REFERENCE ONLY.

NO.	DATE	REVISION DESCRIPTION
2	11-14-01	REMOVED APEX NO. 369
1	8-2-99	CORRECT GASKETS, REVISE 68R APEX INSERT TO SHOW .75", 1.75", 2.25" & 2.5" SIZES.

REVISION STATUS
Rev. By: NP
6

KREBS® ENGINEERS | 6565 WEST GILLETTE ROAD TUCSON, AZ 85743

Scale:	Drn. By:	Date:	Appvd. By:	S.O.
-----	JR	8-24-83	ML WM	

Appvd. Date: 11/16/01
Appvd. By: BNP, PKD
2

SEWAGE DEGRITTING APEXES
NO .168 & 368

A | | DWG. NO. SK977

KREBS® ENGINEERS

Instructions for Installing KREBS Cyclone Liners

General Comments

1. The standard liner material is Neoprene however gum rubber, Butyl, Nitrile, Urethane and other elastomers are available for all sections. Each liner is designed for a firm fit into its corresponding housing and, since all liners are molded, a consistently precise fit is assured. Many liners are designed for a compression fit in the housing, which in some cases gives the initial impression that the rubber liner is too large. However, by following the recommended installation techniques, the liners can be easily installed.
2. The compression of the liners installed in the housings may create elongation to the extent that liner ends project beyond the metal housing. Plywood boards bolted or weighted to each end of the metal housing will compress liners to the proper length until the adhesive sets up which takes from one to two hours.
3. All rubber, or other elastomer inlet head liners, cylinder liners and cone liners (except in the case of urethane, which is more rigid) must be cemented into their housings. Apex liners do not need to be cemented. Recommended adhesive is KrebStik® liner cement, a compound that we stock especially for this purpose. This KrebStik® adhesive also serves as a lubricant helping the liners slide in easily.
4. The adhesive contact surfaces of all rubber and elastomer liners must be thoroughly cleaned prior to applying adhesive. We recommend Toloul, Chevron Socal #3, or another general-purpose solvent.
5. The liner adhesive should be allowed to set up for one to two hours, after liner installation, prior to placing the cyclone in service.
6. Many KREBS Cyclone liners are manufactured with integral soft rubber gaskets that fit between the mating metal housing flanges. These integral gaskets seal the joint as well as prevent slurry from entering between the liner and the housing. All flange bolts should be tightened just snug enough to prevent leakage. Excessive tightening will distort the liner and cause abnormal wear and inefficient performance.

***CAUTION**: Excessive tightening of flange bolts will cause distortion of the liner and will result in abnormally severe wear and possibly liner dislodgment. (When using a torque wrench, 20 ft. – lbs. (27 N-m) is sufficient. DO NOT EXCEED).*

7. Periodic inspections of liners should be made until accurate wear records are determined. A replacement schedule based upon operating time can be established at that time. The liner wear life varies according to its location in the cyclone and it generally is shortest in the lower cone section, where abrasive action is greatest, and decreases progressively upward in the unit. All KREBS Cyclone liners are designed with a slight drop off at each joint by making the I.D. at the bottom of each liner slightly greater than the I.D. of the liner fitting immediately below it. Each joint should be inspected, after assembly, to ensure that there is either a flush fit of the liners or a slight drop off but never a projecting shelf. The lower section liners must be replaced more frequently than the upper liners since liner wear is not equal throughout the cyclone. The upper liner should be replaced however when any liner has worn to the degree that a projecting shelf results from the installation of a new liner below it.

Instructions for Installing KREBS Cyclone Liners (cont'd)

8. The KrebStik® liner cement forms a bond between the liner and the housing strong enough to hold the liner in place during normal operation. It is not a permanent bond however and worn liners may be manually peeled away from the housing when a replacement is necessary. The housing contact surface should be cleaned of dirt and foreign material, but adhesive does not need to be removed. An adhesive other than KrebStik® may be more difficult to use and is not recommended.

9. Liners correctly installed should remain in the proper position indefinitely under normal operating conditions. Liners should be examined for wear, displacement, or tearing however if performance of a cyclone falls below standard.

10. Rubber liners should always be stored in a cool location and never in direct sunlight. KREBS maintains an extremely large inventory of parts and takes pride in the fact that almost all shipments can be made within 24 hours from receipt of order.

    Please contact KREBS for assistance if there are any problems in the installation or operation of KREBS Cyclones. Our staff will be happy to assist you.

Installation of Elastomer Liners

Proper installation of KREBS' gum rubber and other elastomer liners is essential for maximum performance and service. All liners (except apex liners, urethane liners and talon flange style liners) must be cemented into their corresponding metal housings.

Liners are easily replaced by the following procedure:

A. Removal of Old Liners

1. Remove the old liner by grasping one end and "peeling" away the housing. Larger liners may require working from both ends to loosen the entire liner.

2. Remove all dirt and foreign material from the housing. It is not necessary to remove the remaining adhesive material.

3. Clean interior of the housing thoroughly using cleaning solvent (Chevron Socal #3, Toloul, or equal). Install the new liners as detailed on the following pages.

B. Installation of New Liners

NOTE: (i) It is assumed that the interior housing has been thoroughly cleaned with solvent as detailed under "A".

(ii) Please refer to the numbered step-by-step photographs on the following pages.

(iii) Instructions, shown below under 1, 2, and 3, for the cover plate liner apply to 15" and 20" units. For units 10" and smaller, as well as the 26" unit, the cover plate liner overlaps the inlet head liner and it is pressed into place as described in the instructions beginning with number 14, after coating the peripheral edge with KrebStik® adhesive.

1. Liberally apply KrebStik® Liner cement to the exterior surfaces of the cylinder liner and to the interior surface of the cylinder housing. (Never add thinner to reduce the viscosity of KrebStik® liner cement.)

2/3. Fold the cylinder liner to compress it and insert it into the housing section. Both liner flanges must extend past the housing and sit flush on the housing flanges.

4/5. Liberally apply KrebStik® Liner cement to the exterior surfaces of the cone liner and to the interior surface of the cone housing.

6/7. Place the cone liner in the cone housing. Both liner ends must extend past the housing and sit flush on the housing flanges.

8. Punch out the bolt holes in the liner flange on the cylinder liner.

Installation of Elastomer Liners (cont'd)

9. Bolt the inlet housing section to the cylinder housing. Apply KrebStik® Liner cement to the interior surfaces of the inlet housing.

10/11. Insert the inlet head liner into the housing and place the cover plate liner so it is centered in the inlet liner.

12. Place the cover plate gasket over the inlet head liner.

13/14. Place the cover plate on the inlet head and tighten the bolts.

15. Insert the vortex finder with the gasket into overflow opening.

16. Fill the mounting overflow adaptor holes on the cover plate with silicon rubber cement. (Use GE Silicon Adhesive type GP1 or equal.)

17. Position the overflow and the inlet adaptors and tighten the bolts.

18/19. Invert the inlet and the cylinder.

20/21. Punch out the bolt holes in the liner flange on the cylinder and on the cone liners.

22. Place the cone section on the cylinder section and tighten the bolts.

23/24. Place the apex liner and the housing on the cone section and tighten the bolts.

Figure 1

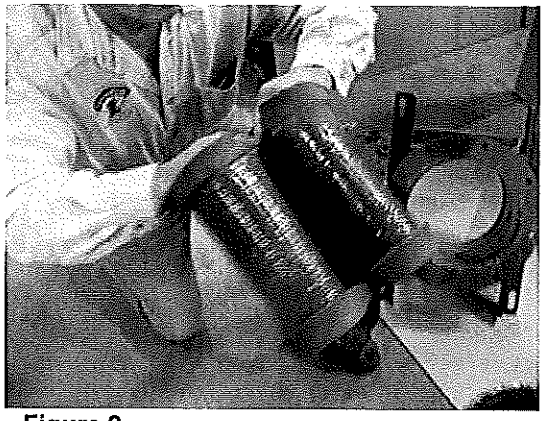


Figure 2

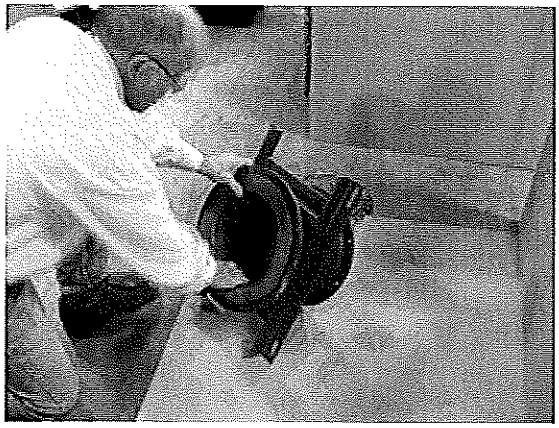


Figure 3

Figure 4

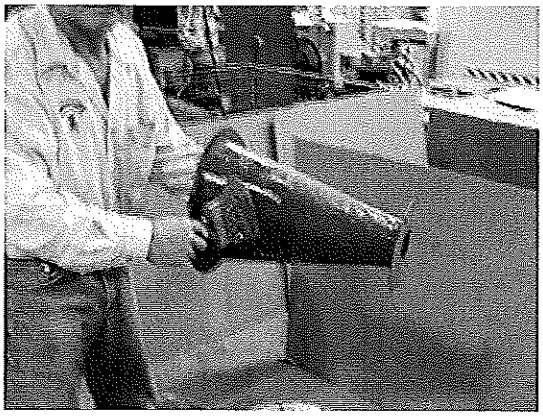


Figure 5

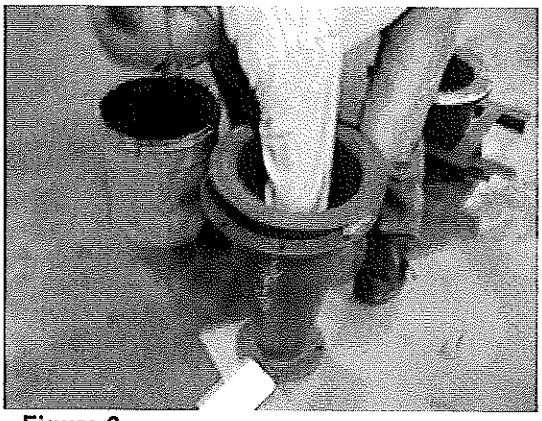


Figure 6

Figure 7

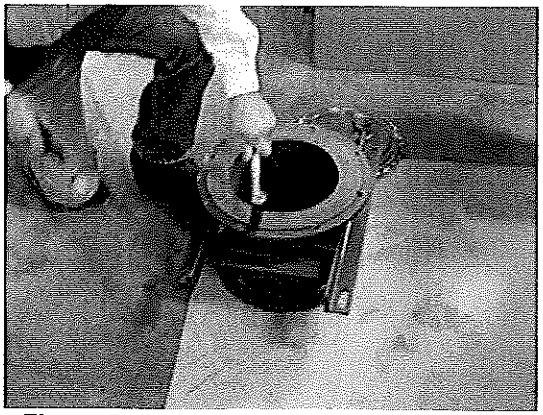


Figure 8

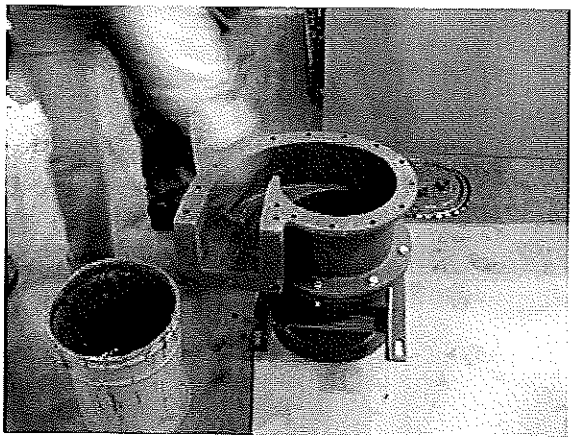


Figure 9

Figure 10

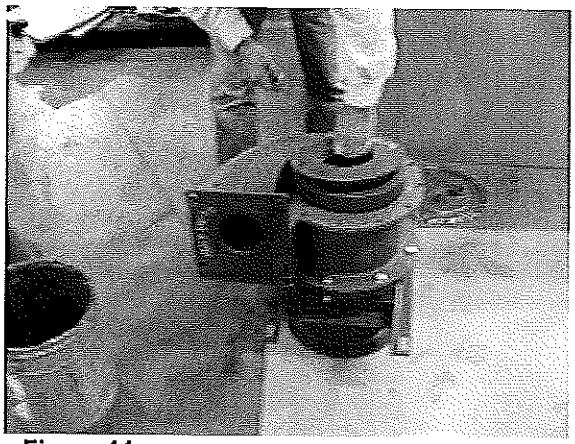


Figure 11

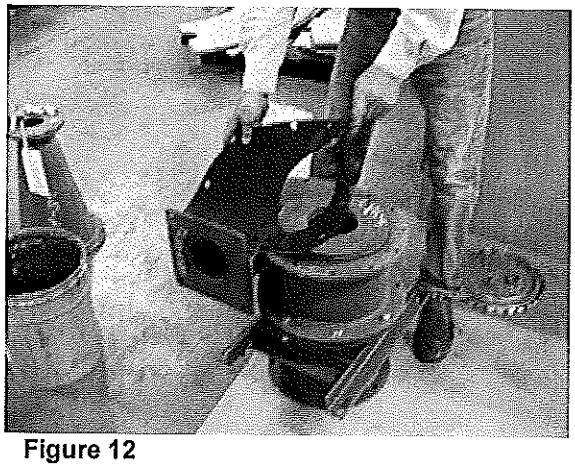
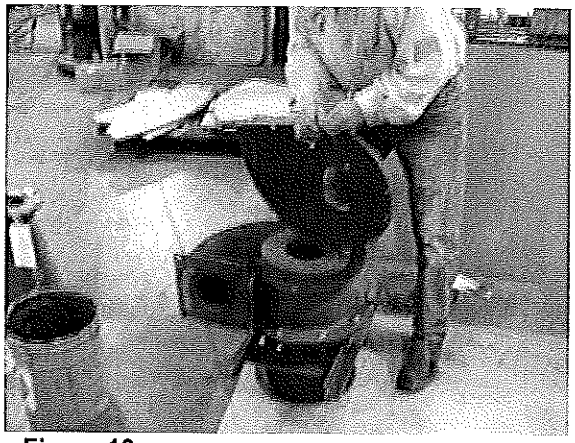


Figure 12



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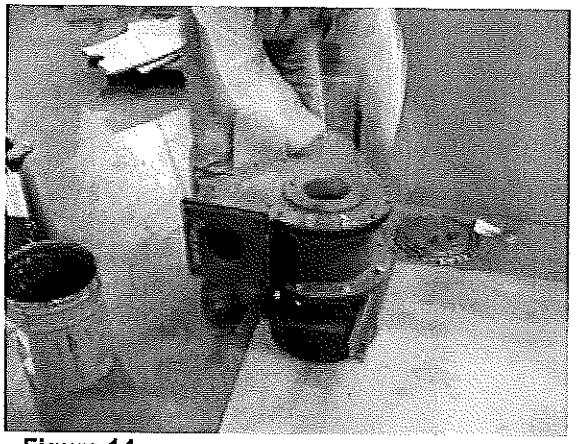

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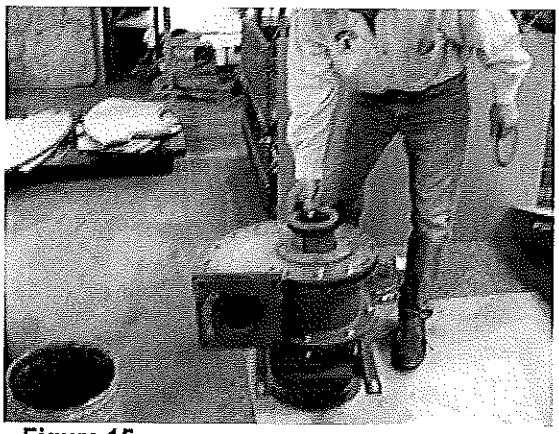

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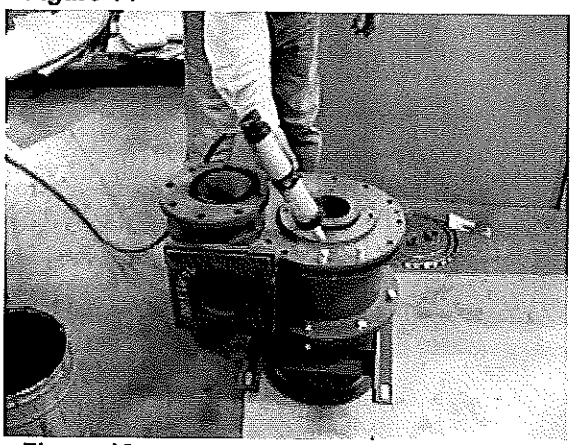

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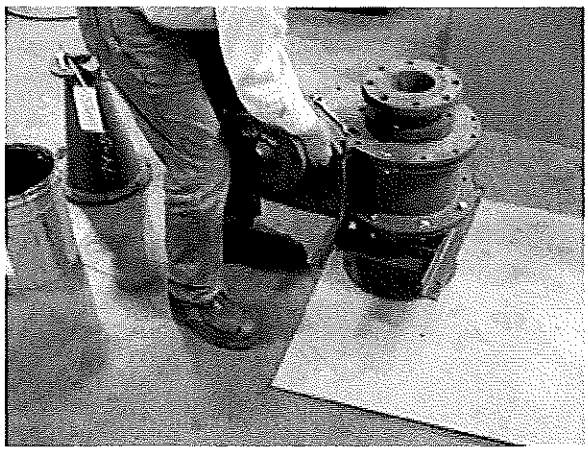

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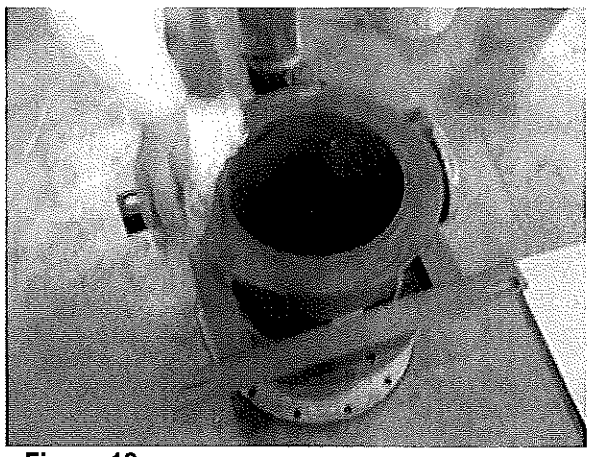

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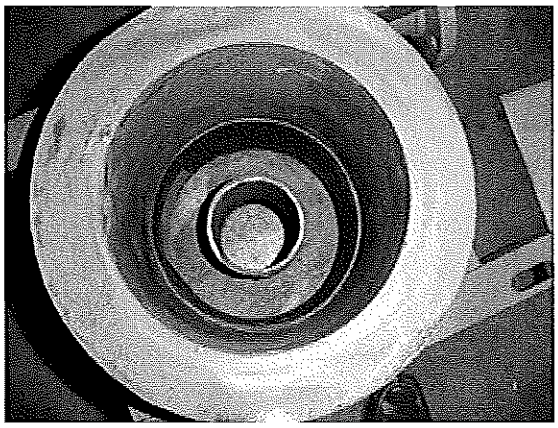
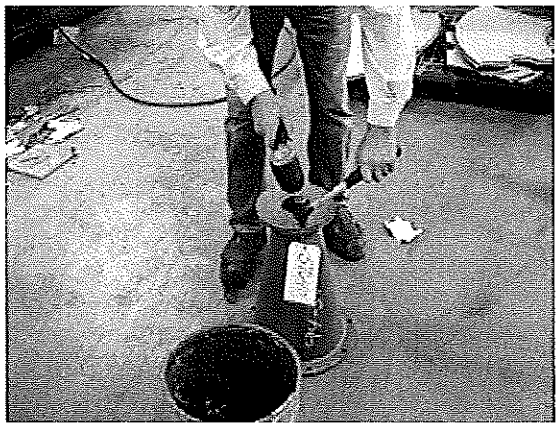


Figure 19

Figure 20



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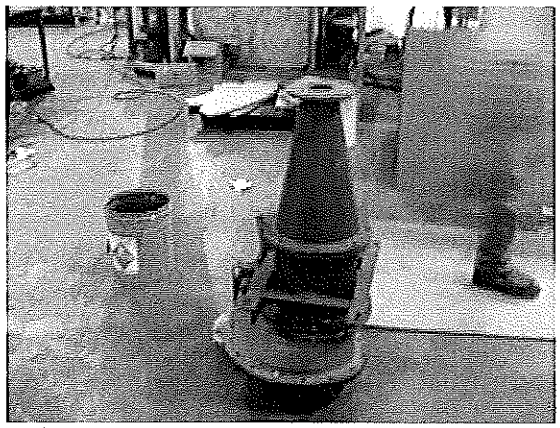


Figure 22

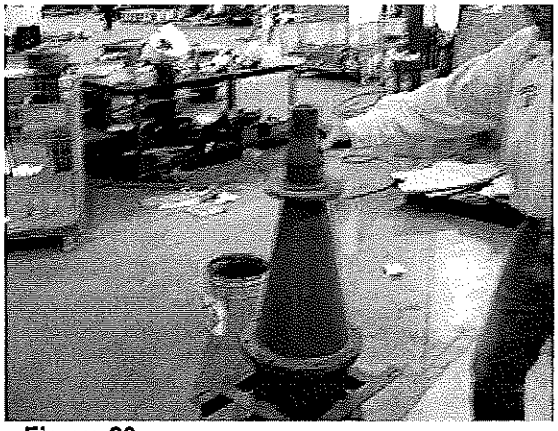


Figure 23

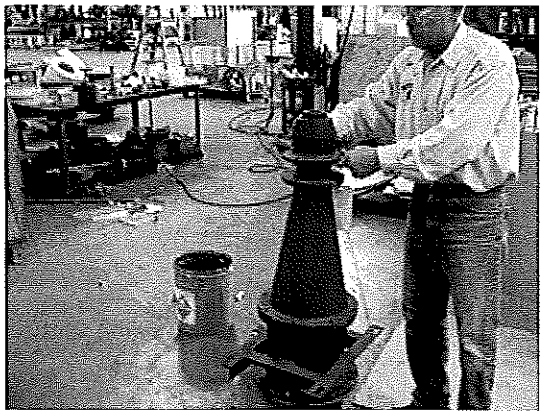
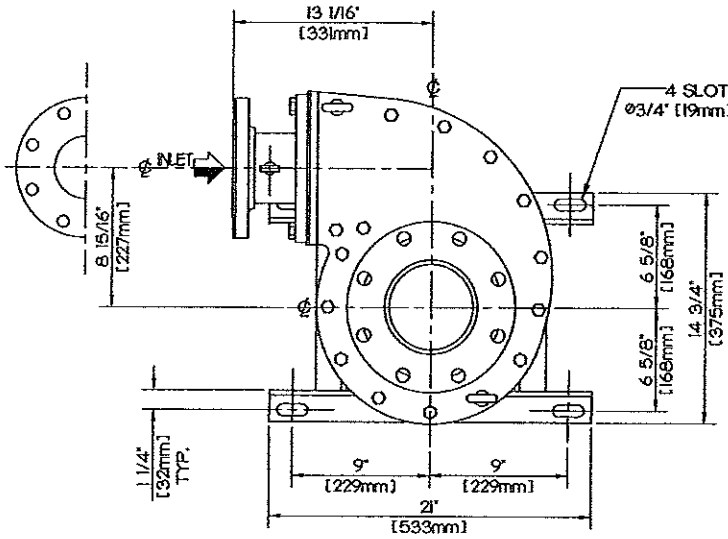


Figure 24

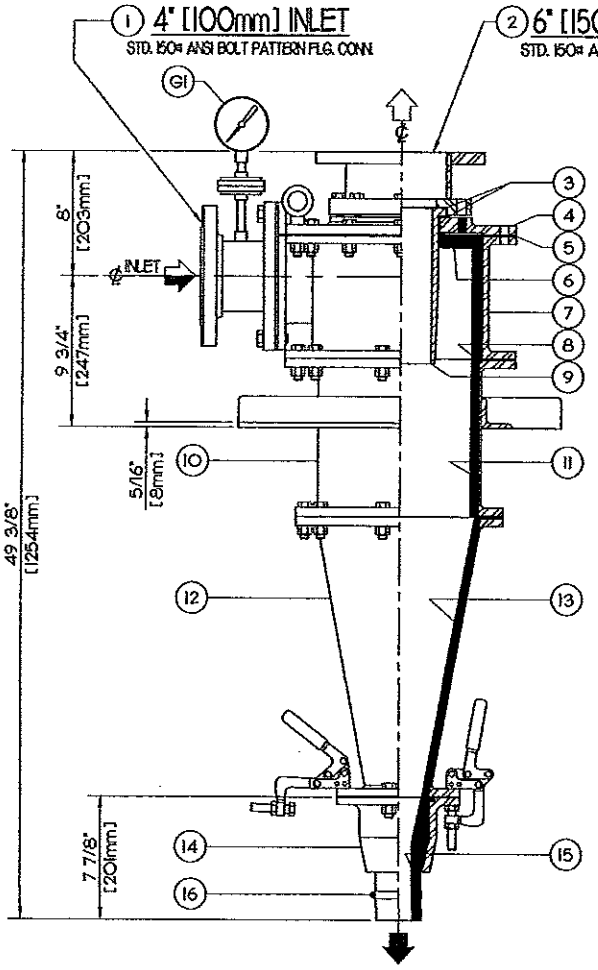
FASTENER REQUIREMENTS						
CONNECTION	DESCRIPTION	SIZE	LENGTH	QTY	SPARE	TOTAL
1 TO 4	HEX BOLT	5/8-11	1 1/2"	2	1	3
1 TO 7	HEX BOLT & NUT	5/8-11	2 1/2"	2	1	3
2 TO 4	HEX BOLT & NUT	1/2-13	1 3/4"	4	1	5
4 TO 7	HEX BOLT & NUT	1/2-13	2"	14	2	16
4 TO 7	EYE BOLT & HEX NUT	1/2-13	2"	2	0	2
7 TO 10	HEX BOLT & NUT	1/2-13	2"	8	1	9
10 TO 12	HEX BOLT & NUT	1/2-13	2"	8	1	9

FASTENER NOTES:

1. ALL BOLTS AND NUTS, TO BE ANSI GRADE 5 ZINC PLATED. (OTHER GRADE/PLATING CAN BE OFFERED)
2. WASHERS TO BE USED ON ALL SLOTTED HOLES.
3. PLEASE NOTIFY CUSTOMER SERVICES OF ANY DEVIATION IN THIS LIST.
4. NO PAYMENT FOR CUSTOMER MODIFICATIONS, BACK CHARGES, OR ANY OTHER CHANGES WILL BE ACCEPTED, UNLESS PREVIOUSLY AUTHORIZED BY FLSmidth KREBS.
5. QUANTITIES SHOWN ARE FOR THE ASSEMBLY OF ONE CYCLONE.



PLAN



SCHLOSS ENGINEERED EQUIPMENT / INDUSTRIAL TECHNOLOGIES INC.
CUSTOMER P.O. NO: EBI-1757C / SERIAL NO: 132884U

ITEM No.	PART NUMBER	DESCRIPTION
1.	152F-ST-4F	INLET FLANGED ADAPTER, 4" SIZE, 150# ANSI R.F., S.O., FLANGE CONN., STEEL.
GI.	PI-PL274-30	PRESSURE GAUGE ASSEMBLY (0-30) PSI GRADUATION
2.	C3241-ST-4F	OVERFLOW FLANGED ADAPTER, 6" SIZE, STD. 150# ANSI BOLT PATTERN FLG. CONN., STEEL.
3.	105GL-RN	GASKET, NEOPRENE. (2 REQUIRED)
4.	103L-ST-5	TOP COVER PLATE, STEEL.
5.	C2156G-2-RN	GASKET, NEOPRENE.
6.	103R-BPC-5	TOP COVER PLATE LINER, BPC RUBBER.
7.	102L-ST	INLET HEAD, STEEL.
8.	102LR-BPC-9.6	INLET HEAD LINER, 9.6 SQ. IN. INLET ORIFICE, BPC RUBBER.
9.	105L-NH-4	VORTEX FINDER, 4" SIZE, NI-HARD.
10.	104L-ST-MF	CYLINDER WITH MOUNTING FRAME, STEEL.
11.	104R-BPC	CYLINDER LINER, BPC RUBBER.
12.	94-ST-C7709	CONE HOUSING, WITH TOGGLE CLAMPS, STEEL.
13.	94R-BPC	CONE LINER, BPC RUBBER.
14.	168-ST	APEX HOUSING, STEEL.
15.	68R-BPC-2	APEX INSERT, 2" SIZE, BPC RUBBER.
16.	C7716-SS	CLAMP, STAINLESS STEEL.

FINAL CERTIFICATION

CERTIFIED FOR: Schloss Engineered Equipment/Industrial Technologies Inc.
P.O. No. EBI-1757C
S.O. No. 142146 QUAN. 1
MODEL D10LB-S845-SDM
SERIAL NO. 132884U
BY _____ DATE 03-24-12

5505 WEST GILLETTE ROAD
TUCSON, ARIZONA 85743
PHONE: (520) 744-8200 FAX: (520) 744-8300

FLSmidth KREBS

NOTES:

1. PAINT: EN-SPEC-4-3041
2. BARE WEIGHT: 300 # [136 kg]
   SHIPPING WEIGHT: 420 # [191 kg]

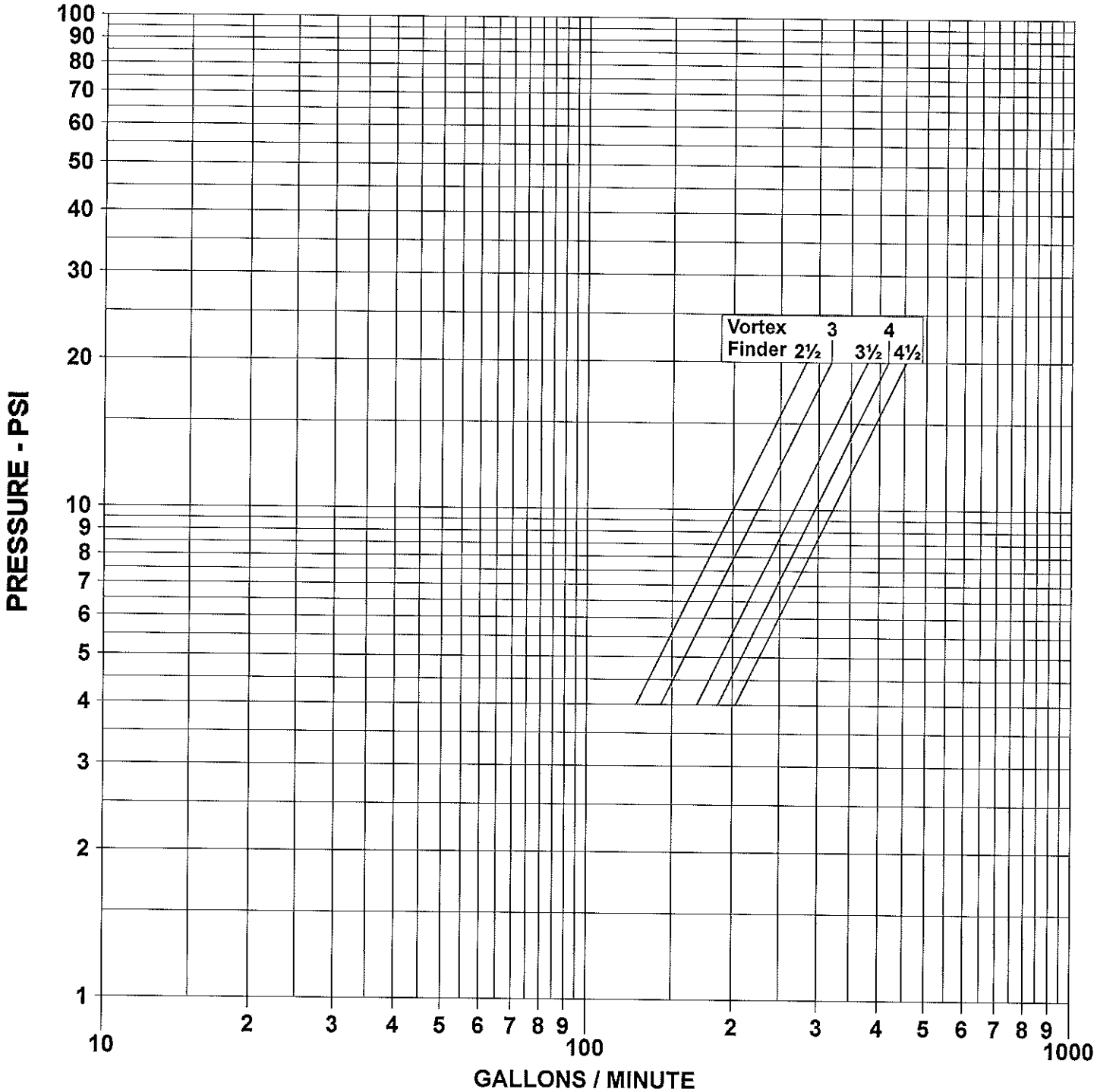
TOLERANCE SCHEDULE: UNLESS OTHERWISE SPECIFIED.		
-24"=±1/4"	+24" thru 100"=±1/2"	+100"=±1"
[-600mm = ±6mm]	[+600mm thru 2500mm = ±12mm]	[+2500mm = ±25mm]

REVISION Rev. By:	FLSmidth KREBS	5505 WEST GILLETTE ROAD TUCSON, AZ 85743 www.krebs.com
Rev. Date: 2/27/12	Scale: ----	Dwn. By: MMB / Date Drawn: 2-23-12 / Appvd. By: CW 4/0/12 / Sheet: 1 OF 1
Appvd. By: 0	GENERAL PARTS ARRANGEMENT KREBS CYCLONE MODEL D10LB-S845-SDM WITH ADJUSTABLE APEX ASSEMBLY NO. 168	
C	© FLSmidth KREBS 2012	DWG. NO. S845--SDM--132884U

Krebs Cyclone
Model No.: D10LB-SDM

CAPACITY CURVE
No.: D10LB-SDM-960-(11.25)-1197

9.60 SQ. IN. INLET ORIFICE



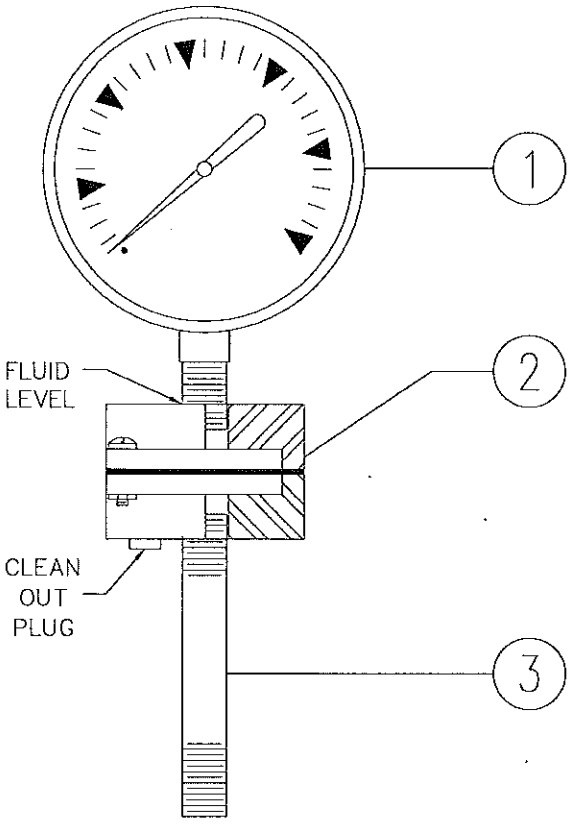
CAPACITY IS BASED ON WATER AT AMBIENT TEMPERATURE AND APEX DIAMETER EQUAL TO ONE HALF THE VORTEX FINDER DIAMETER, AND MAY VARY AT DIFFERENT RATIOS

KREBS ENGINEERS
5505 West Gillette Road
Tucson, AZ 85743
TEL: (520) 744-8200
FAX: (520) 744-8300
e-mail: www.krebs.com

REVISION 11

KREBS CYCLONE PARTS LIST

Pressure Gauge & Diaphragm Assembly



Revised To Date: November 20, 2009

	PART NUMBER	DESCRIPTION
1.	PI-GAUGE-015	Pressure Gauge, Bourdon Tube Type With 3.5" Diameter Dial, 0-15 P.S.I. Graduations With .25" NPT Connection.
	PI-GAUGE-030	Pressure Gauge, Bourdon Tube Type With 3.5" Diameter Dial, 0-30 P.S.I. Graduations With .25" NPT Connection.
	PI-GAUGE-060	Pressure Gauge, Bourdon Tube Type With 3.5" Diameter Dial, 0-60 P.S.I. Graduations With .25" NPT Connection.
	PI-GAUGE-100	Pressure Gauge, Bourdon Tube Type With 3.5" Diameter Dial, 0-100 P.S.I. Graduations With .25" NPT Connection.
	PI-GAUGE-160	Pressure Gauge, Bourdon Tube Type With 3.5" Diameter Dial, 0-160 P.S.I. Graduations With .25" NPT Connection.
	PI-GAUGE-300	Pressure Gauge, Bourdon Tube Type With 3.5" Diameter Dial, 0-300 P.S.I. Graduations With .25" NPT Connection.
	PI-GAUGE-600	Pressure Gauge, Bourdon Tube Type With 3.5" Diameter Dial, 0-600 P.S.I. Graduations With .25" NPT Connection.
2.	PI-DIAPHRAGM	Diaphragm Assembly Complete With Viton Diaphragm, .25" N.P.T. Connections & Allen Type Cleanout Plug, Aluminum Alloy.
3.	PF-NIP-.25X3GA	Pipe Nipple, .25"X3" Long, Galvanized Steel.

NOTE:

Upper Chamber of Body Must Be Filled With Fluid-Any Light Weight Machine Oil Is Suitable.

Material Symbols: (01-16-97)											
AL: Aluminum	CC: 90% Alumina	CX: Reaction Bonded Silicon Carbide	NK: Nickel	PA: Plastic	RE: EPDM	RJ: White Nitrile	RU: 90 Durometer Urethane	RV90: 90 Duro. Viton	SI: 625 Inconel		
AR: AR Plate	CG: Silicon Carbide Composite	CZ: Sintered Alpha Silicon Carbide	NR: Niresist	PV: PVC	RF: Food Grade Neoprene	RK: Ultrane HT	RU7: Urethane	RW: Ultrane II	SS: Stainless Steel		
AT: Alloy 20	CI: Cast Iron	G: Gasket	PC: CPVC	RA: Vibrathane Compound 6063	RG: Gum Rubber	RM: White Urethane(95)	RU95: 95 Durometer Urethane	RX: Silicon Rubber	SSB: Boride Coated SS		
BG: Black Gold	CQ: Super Refrax-K	GF: Gylon Fawn	PF: FRP	RB: Chlorobutyl	RH: Nitrile	RN: Neoprene	RV: Viton	RY: Ultrane II (93)	SS6: AL-6XN		
BPC: BPC Rubber	CR: Nitride Bonded Silicon Carbide	ML: Monel	PK: Kynar PVDF	RC: Royal Cast	RI: High Temp. Urethane	RP: Hypalon	RV75: 75 Durometer Viton	RZ: Ultrane V	SDB: Boride Coated SD		
CB: 96% Alumina	CS: Cast Steel	NH: Nihard	PN: Nylon	RD: Compressed Non-Asbestos		RQ: Food Grade Rubber Compound 9150		SA: Hastelloy	SD: Stainless Duplex		
			PP: Polypropylene			RT: Ultrane II (Food Grade)		SC: CD4MCU	SI: Titanium		
			PT: Teflon						XZ: Corrosion Resist. Units		

NP

PLEASE SPECIFY PART NUMBER AND CYCLONE SERIAL NUMBER WHEN ORDERING PARTS.

KREBS ENGINEERS

CORPORATE OFFICES - TUCSON, USA
PHONE: (1-520) 744-8200
FAX: (1-520) 744-8300
krebs@krebs.com

KREBS ENGINEERS AFRICA (Pty) Ltd.
PHONE: (27-11) 444-3662
FAX: (27-11) 444-6126
krebsafrica@krebs.com

KREBS AUSTRALIA PTY. LTD
PHONE: (61-7) 5571-6760
FAX: (61-7) 5571-6762
krebsaustralia@krebs.com

KREBS ENGINEERS GmbH AUSTRIA
PHONE: (43-2167) 3345
FAX: (43-2167) 3337
krebsgmbh@krebs.com

KREBS ENGINEERS BRASIL Ltda.
PHONE: (55-11) 4787-3555
FAX: (55-11) 4787-3401
krebsbrasil@krebs.com

KREBS ENGINEERS CHILE S.A.
PHONE: (56-2) 463-8300
FAX: (56-2) 463-8383
krebschile@krebs.com

KREBS ENGINEERS PACIFIC
PHONE: (63-2) 633-5705
FAX: (63-2) 637-7281
krebspacific@krebs.com

SECTION IV

CONTROLS

Second Generation CEP7 Solid State Overload Relays

Advanced solid state motor protection

The introduction of the second generation of CEP7 solid state overload relays advances Sprecher + Schuh's leading edge technology with several improved features. This second generation of CEP7 overload relay includes features like:

- Selectable trip class and field installable modules
- A wider (5:1) set current adjustment range
- A more robust mechanical and electrical mounting
- Self-sealed latching mechanism

The basic concept of utilizing Application Specific Integrated Circuits (ASICs) resulting in an affordable solid state overload relays remains unchanged. This kind of versatility and accuracy was simply not possible with traditional bi-metallic or eutectic alloy electromechanical overload relays.

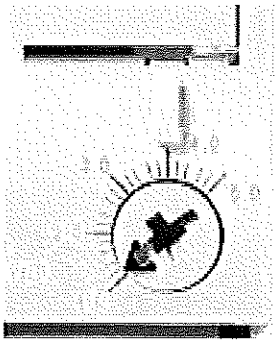
Fewer units means greater application flexibility

The new CEP7 is available in three basic models:

- CEP7-ED1 is a Class 10, manual reset model available up to 27 amperes which covers the most common horsepower motors and your every day application. This model is economically priced to be competitive with adjustable bi-metallic overload relays.
- CEP7-EE is full featured selectable trip class (10, 15, 20 & 30) 3-phase application overload relay with provision for field mountable modules to handle remote reset, stall and other modules previously available only in higher priced electronic overload relays. Manual reset or automatic reset can be selected with dip switches on the new CEP7-EE models.
- CEP7S-EE is a 1-phase application overload relay packing all features of the 3-phase CEP7-EE model.

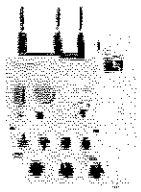
Wide current adjustment range

Thermal or bimetallic overload relays typically have a small current adjustment range of 1.5:1 meaning that the maximum setting is generally 1.5 times the lower setting. The



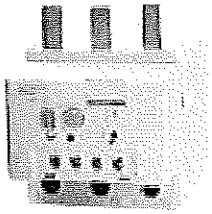
first generation of CEP7 caused the industry to take note of the flexibility when it introduced a 3.2:1 adjustment ratio. A wider adjustment range is the primary reason the industry has been turning to more specifications calling for electronic overload relay protection over thermal overload relays. Sprecher + Schuh building on field experience now introduces a CEP7 overload capable of adjustment to a maximum of five times the minimum set current which dramatically reduces the number of units required on-hand to cover the full range of current settings up to 90 amperes.

5 : 1 Current Range

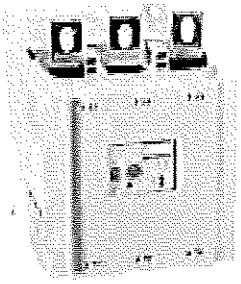


27A

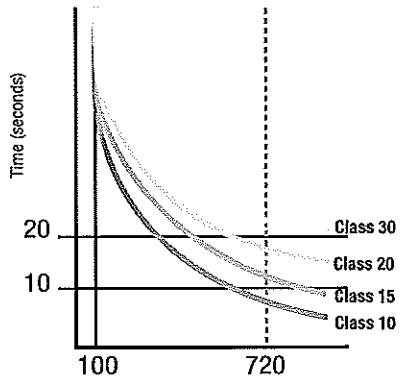
45A



90A



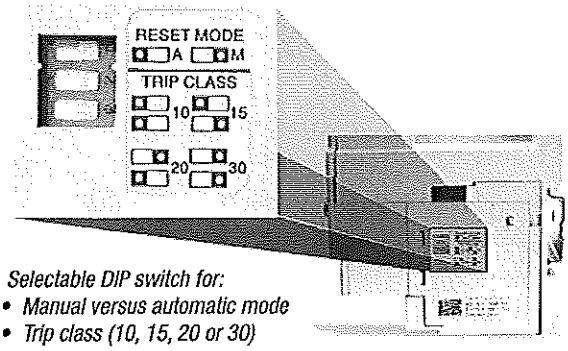
30A 800A



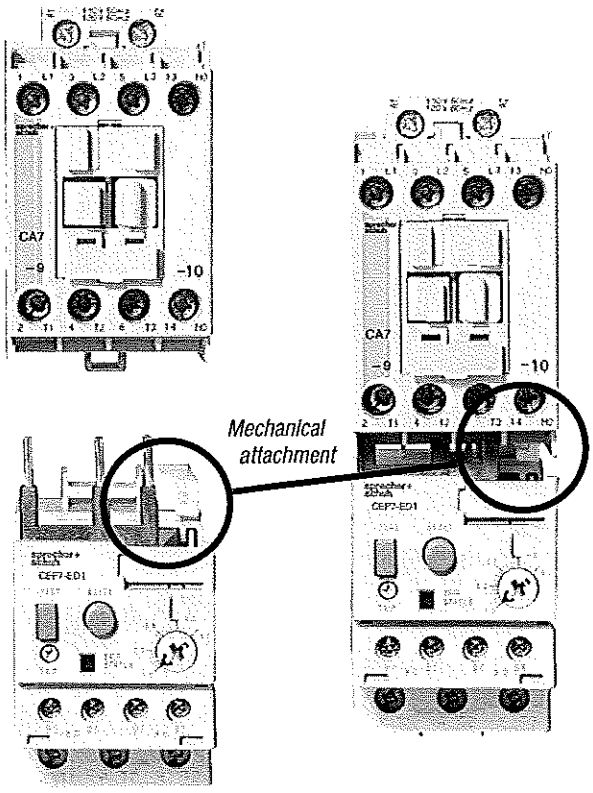
CEP7 overload relays are available with Class 10, 15, 20 or 30 tripping characteristics

Selectable tripping class

Because of today's lighter T-frame motors, Class 10 overload relays (relays that trip within 10 seconds of a locked rotor condition) have become the industry standard. If your application requires a longer motor run-up time. The new CEP7-EE Selectable Trip Class has DIP-switches providing Trip Class selection of 10, 15, 20 or 30 seconds. This ability allows you to closely match the Trip Class with the run-up time of the motor.



Selectable DIP switch for:
- *Manual versus automatic mode*
- *Trip class (10, 15, 20 or 30)*

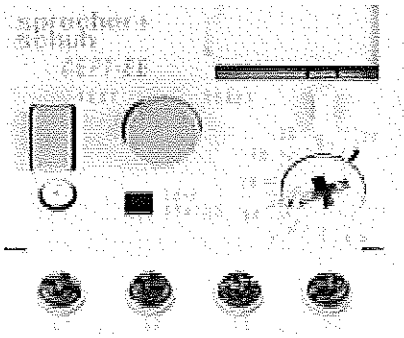


Choice of reset options

Most industrial applications usually calls for an overload relay that must be manually reset in the event of a trip. This allows the cause of the overload to be identified before the motor is restarted. In specialized cases, however, such as rooftop AC units or where restarting the motor will not harm people or equipment, automatic reset may be desired. CEP7-ED1 overload relays are available with Manual Reset exclusively which keeps the cost down. CEP7-EE models have a dip switch selectability in Manual and Automatic Reset modes.

More robust design

The CEP7 has been re-designed to physically extend to the back-pan therefore aligning the mounting of the overload with the corresponding contactor. Further, the mechanical attachment and direct electrical connection to the contactor has been "beefed-up." This provides for a more robust mounting which means less damage from shipping or during field wire installation. The bipolar latching relay which controls the normally closed trip contacts and normally open alarm circuit contacts have been self-enclosed therefore insolating the electro-magnet and shielding against airborne metal particles and other potential environmental debris. The new CEP7 has been tested to operate in -20° C. or up to 60° C (140 °F.) and withstand 3G of vibration or 30G of shock on a mountain up to an altitude of 2000m or in a jungle at 95% humidity. Reliability under every conceivable environmental condition is a quality built into the design of this second generation of CEP7 electronic overload relay.



Increased accuracy and improved motor protection

Microelectronics provides flexible and accurate motor overload protection. Unlike traditional overload relays that simulate heat build-up in the motor by passing current through a heater element, CEP7 solid state overload relays measure motor current directly through integrated current transformers. The transformers, in turn, create a magnetic field that induces DC voltage onto the ASIC board. The electronics identify excessive current or loss of phase more accurately, and react to the condition with greater speed and reliability, than traditional overload relays. In addition, CEP7 solid state relays offer setting accuracies from 2.5 – 5% and repeat accuracy of 1%.

Self-powered design means convenience

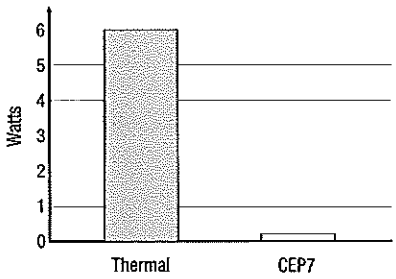
By developing the power it requires from the applied voltage, the CEP7 is "self-powered," eliminating the need for a separate control power source. This is not the case with some other competitive electronic overload relays. Since the CEP7 is self-powered and a traditional auxiliary contact is used to interface with the contactor, the user can apply the CEP7 the same way as an electromechanical overload. No special connections or control schematic diagram provisions are required in 3-phase applications.

Dramatically lowered energy requirement saves money, reduces panel space

Because traditional overload relays work on the principle of "modeling" the heat generated in the motor (recreating the heat in the bimetal elements or heaters), a significant amount of energy is wasted. In traditional bi-metallic overload relays, as many as six watts of heat are dissipated to perform the protective function. Because the CEP7 uses sampling techniques to actually measure the current flowing in the circuit, very little heat is dissipated in the device...as little as 150 milliwatts. This not only reduces the total amount of electrical energy consumed in an application, but it can also have a dramatic impact on the design and layout of control panels. The density of motor starters can be much greater because less heat is generated by each of the individual components. Higher density results in smaller control panels. In addition, special ventilation or air conditioning that might have been required to protect sensitive electronic equipment such as PLC's can now be reduced or eliminated. CEP7 overload relays dramatically reduced energy requirement saves money and reduces panel space.

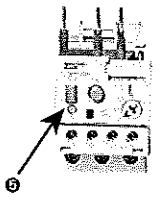
Superior phase failure protection

The CEP7's on-board electronics are constantly monitoring all three phases. If the ASIC board senses that one phase is missing during a steady state running condition on a fully loaded motor, it will trigger in 3 seconds. If a single phase condition is present during starting, the CEP7 will trip within 8 seconds (for a motor >80% loaded). These times are much faster than any thermal bi-metallic overload relay. In addition, CEP7 overload relays detect a 50% phase imbalance in the same way as a phase loss.

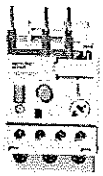
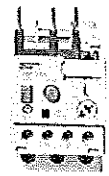


Conventional overload relays dissipate as much as six watts of energy compared with as little as 150 milliwatts for the CEP7

Directly Mounted CEP7 Solid State Overload Relays, Manual Reset ❶❷❹

Overload Relay	Directly Mounts to Contactor... ❷	Adjustment Range (A)	Trip Class 10	
			Catalog Number	Price
Manual Reset for 3Ø Applications ❶				
 ❺	CA7-9...CA7-23	0.1...0.5	CEP7-ED1AB	46
		0.2...1.0	CEP7-ED1BB	46
		1.0...5.0	CEP7-ED1CB	46
		3.2... 16	CEP7-ED1DB	46
		5.4...27	CEP7-ED1EB	46

Directly Mounted CEP7 Solid State Overload Relays, Automatic/Manual Reset ❶❷❸❹

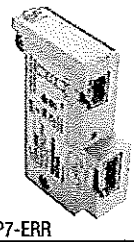
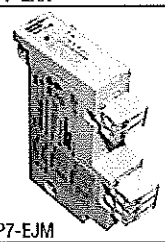
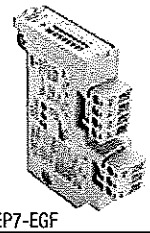
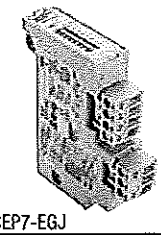
Overload Relay	Directly Mounts to Contactor... ❷	Adjustment Range (A)	Adjustable Trip Class 10, 15, 20 & 30	
			Catalog Number	Price
Automatic or Manual Reset for 3Ø Applications ❶				
	CA7-9...CA7-23	0.1...0.5	CEP7-EEAB	52
		0.2...1.0	CEP7-EEBB	52
		1.0...5.0	CEP7-EECB	52
		3.2... 16	CEP7-EEDB	52
		5.4...27	CEP7-EEEB	52
	CA7-30...CA7-43	1.0...5.0	CEP7-EECD	82
		3.2...16	CEP7-EEDD	82
		5.4...27	CEP7-EEED	82
		9...45	CEP7-EEFD	82
	CA7-60...CA7-85	5.4...27	CEP7-EEEE	95
		9...45	CEP7-EEFE	95
		18...90	CEP7-EEGE	100
Automatic or Manual Reset for 1Ø Applications ❶				
	CA7-9...CA7-23	1.0...5.0	CEP7S-EEPB	52
		3.2...16	CEP7S-EERB	52
		5.2...27	CEP7S-EESB	52
	CA7-30...CA7-43	9...45	CEP7S-EETD	95
	CA7-60...CA7-85	18...90	CEP7S-EEUE	100

TIP!

Most industrial applications usually call for an overload relay that must be manually reset in the event of a trip. This allows the cause of the overload to be identified before the motor is restarted. An overload relay that resets automatically is generally for specialized, or remote applications, such as rooftop AC units where restarting the motor will not harm people or equipment.

❶ 3-phase CEP7 units are only designed for 3Ø applications. Single phase CEP7S units are only designed for single phase applications.
❷ This reference is not intended to be a guide for selecting contactors. Size overload relays using the full load current of the motor.
❸ The reset time of a CEP7 set in the automatic mode is approximately 180 seconds.
❹ CEP7 overload relays do not work with Variable Frequency Drives, DC Applications or Softstarters with braking options.
❺ The mechanical trip actuator will become functional on shipments of CEP7 second generation starting April 2006. The exact date of Field availability may depend on levels of stock on-hand.

Accessories - CEP7 Side Mount Modules ❶❸

Accessory	Description	For use with...	Catalog Number	Price	
 CEP7-ERR	**Remote Reset Module** • Provision for reset after trip from remote pilot device	Side-mount to any CEP7-EE_ CEP7S-EE_	**CEP7-ERR**	60	IN STOCK NOW
 CEP7-EJM	**Jam Protection and Remote Reset Module** • Dip switch adjustable Jam Protection - Jam set points -150%, 200%, 300%, or 400% FLA - Trip delay- 0.5, 1, 2, or 4 sec. • Provision for reset after trip from remote pilot device		**CEP7-EJM**	70	IN STOCK NOW
 CEP7-EGF	**Ground Fault Protection and Remote Reset Module ❷** • Dip switch adjustable Ground Fault Protection > GF Current range set points - 20...100ma - 100...500mA - 0.2...1.0A - 1.0...5.0A > GF Trip level 20%-100% • LED status indication • Provision for reset after trip from remote pilot device	Side-mount to any CEP7-EE_ CEP7S-EE_ Must use with CEP7-CBCT_ Current Sensor	**CEP7-EGF**	70	IN STOCK NOW
 CEP7-EGJ	**Ground Fault/Jam Protection and Remote Reset Module ❷** • Dip switch adjustable Ground Fault Protection same as CEP7-EGF shown above. • Jam trip when the motor current exceeds 400% FLA setting when enabled. • LED status indication • Provision for reset after trip from remote pilot device		**CEP7-EGJ**	90	IN STOCK NOW
 CEP7-EPT	**PTC Thermistor Relay and Remote Reset Module** • PTC Protection and LED Status indication Type of Control Unit: Mark A Number of Sensors: 6 Maximum Cold Resistance of Sensor Chain: 1500 Trip Resistance: 3400 ± 150 Reset Resistance: 1600 ± 50 Short Circuit Trip Resistance: 25 ± 10 Open Circuit Trip Resistance: > 20,000 Maximum Voltage at 1T1 / 1T2 (Rptc=4k): < 7.5 Vdc Maximum Voltage at 1T1 / 1T2 (Rptc=open): < 30 Vdc PTC Response Time: 500ms...800ms • Provision for reset after trip from remote pilot device	Side-mount to any CEP7-EE_ CEP7S-EE_	**CEP7-EPT**	75	IN STOCK NOW
	**Adjustment Cover for External Modules**	All modules with DIP Switches	**CEP7-EMC**	4	IN STOCK NOW

❶ Side mount modules must have 24 - 240V, 47 - 63HZ or DC applied to terminals A1 and A2 for control power.
❷ ATTENTION: The CEP7 Overload relay is not a ground fault circuit interruptor for personnel protection as defined in Article 100 of the NEC.
❸ See page B11.1-B11.3 for Technical Data, Wiring, and DIP Switch set up.

Technical Information

Environmental Ratings

Ambient Temperature	Storage	[°C]	-40...+85 (-40...+185 °F)
	Operating	[°C]	-20...+60 (-4...+140 °F)
Humidity	Operating	[%]	5...95, non-condensing
	Damp Heat		per IEC 68-2-3 and IEC 68-2-30
Vibration (per IEC 68-2-6)		[G]	3
Shock (per IEC 68-2-27)		[G]	30
Maximum Altitude		[m]	2000
Pollution Environment			Pollution Degree 3
Degree of Protection			IP20
Type of Relay			Ambient compensated, time delay, phase loss standard
Nature of Relay			Solid-state
Trip Rating			120% FLA
Trip Class	Type ED		10
	Type EE		10, 15, 20, 30
Reset Mode	Type ED		Manual
	Type EE		Manual or Automatic

Electromagnetic Compatibility

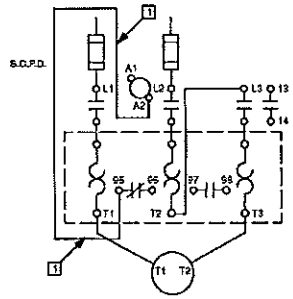
Electrostatic Discharge Immunity	Test Level	[kV]	8kV air discharge 6kV contact discharge
	Performance Level		1 ❶❷
RF Immunity	Test Level	[V/m]	10 V/m
	Performance Level		1 ❶❷
Electrical Fast Transient Burst Immunity	Test Level	[kV]	4 kV
	Performance Level		1 ❶❷
Surge Immunity	Test Level	[V/m]	2 kV (L-E) 1 kV (L-L)
	Performance Level		1 ❶❷

General

Standards	UL 508, CSA C22.2 No. 14, NEMA (CD2-1993 Part 4, EN 60947-4-1, EN 60947-5-1			
Approvals	CSA, UL, ATEX (pending)			
			CEP7-ED1...B **CEP7-EE...B**	**CEP7-EE...D**	**CEP7-EE...E**
Weights (unpackaged)		[Kg]	0.25	0.25	0.52
		[Lb]	0.55	0.55	1.06

Wire Schematics

Typical Wiring
for Single Phase Applications



CEP7 Single Phase Overload Relay
Must be connectd as shown in Fig. 1 or 2 only.

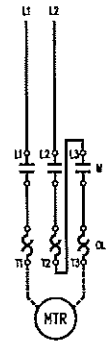


Fig. 1
Recommended connections for CEP7S (i.e. 240V motors)

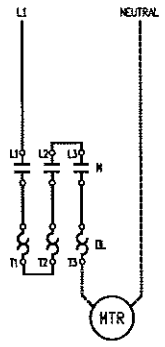


Fig. 2
Optional connections for CEP7S (i.e. ≤120V motors)

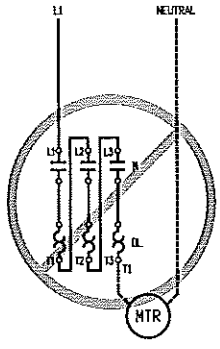


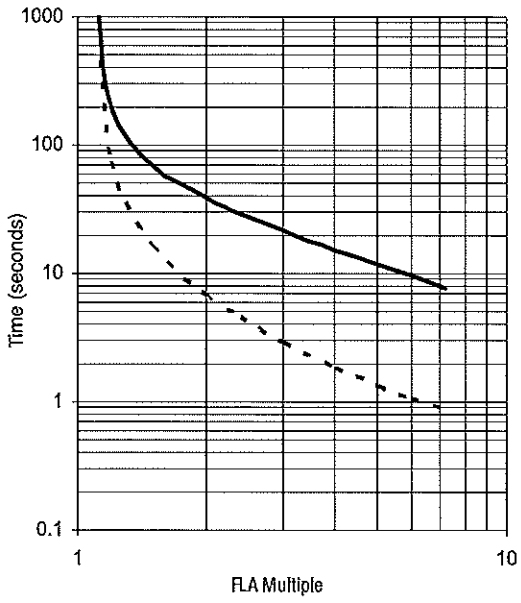
Fig. 3
❸ DO NOT USE

❶ Performance Criteria 1 requires the DUT to experience no degradation or loss of performance.
❷ Environment 2.
❸ If the CEP7S is connected as shown in Fig. 3 the overload will not trip! The CEP7S contains an electronic circuit board that is self powered. If connected as shown in Fig. 3, the CEP7S circuit board will not power up and the CEP7S would not trip.

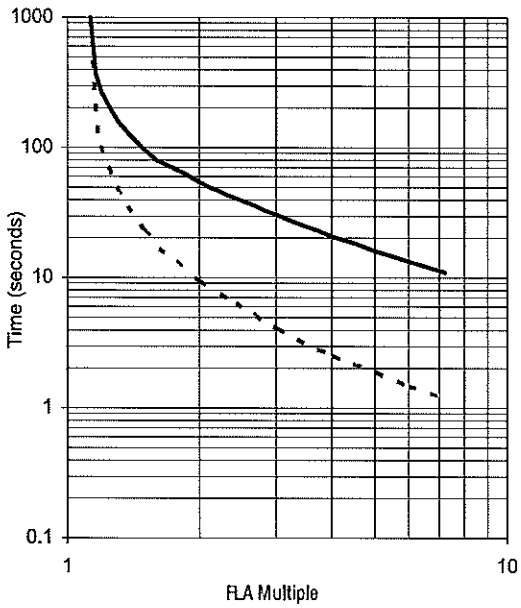
Technical Information

Trip Curves ❶

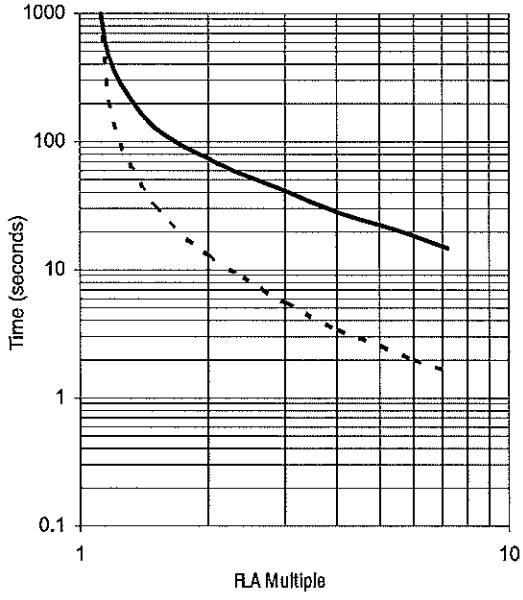
Trip Class 10



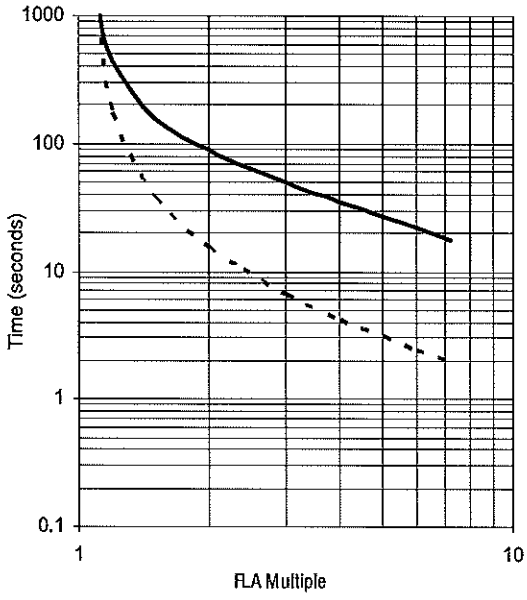
Trip Class 15



Trip Class 20



Trip Class 30



Trip Curve Legend

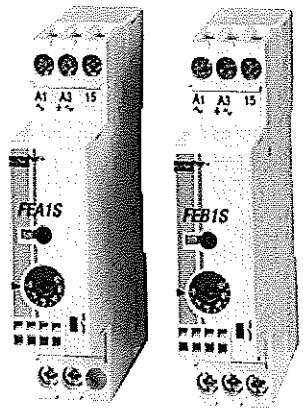
Cold Trip ——————
Hot Trip - - - - -

❶ Typical reset time for CEP7 Second Generation devices set to "automatic reset" mode is 120 seconds.

RZ7-FE Electronic Timing Relays

The economical choice for most industrial timing applications

Sprecher + Schuh's RZ7-FE electronic timing relays offer seven popular output functions in an economical package. This series is especially designed for applications where a high quality, yet basic timing relay is required. Timing formats include ON-delay, OFF-delay, Wye-Delta and four other choices. All models are multi-time relays, meaning that various time ranges (from 0.05 seconds to 10 hours) can be selected from the face of the relay.



Solid state accuracy and reliability

Except for their hard silver contacts, all RZ7-FE timing relays are built with solid state surface mounted electronics and are accurate to within one percent. Their ruggedness and accuracy is due to the thorough testing of function, timing characteristics and surge voltage strength performed on *each device* prior to shipment.

In addition, RZ7-FE relays function reliably from 15% under rated operating voltage to 10% over rated operating voltage (AC). Voltage tolerance is even greater in DC applications.

Universal voltage capability

All RZ7-FE timing relays operate with multiple supply voltages ranging from 24VAC or DC to 240VAC. Universal voltage capability means smaller inventories and more flexibility.

Choose from two different output contacts

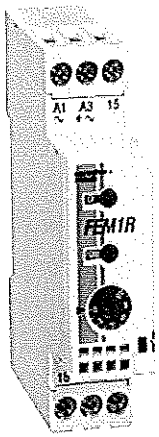
New to the RZ7-FE series is the choice between one normally open (NO) contact or one single pole double throw (SPDT) contact. The new SPDT version can be used either normally open or normally closed. This version has several technical advantages such as shorter impulse duration requirements and a faster recovery time.

Multiple functions in one relay

The RZ7-FEM relay combines four of the most popular timing functions into one device. Six timing ranges are included that are individually selectable from 0.05 seconds to 10 hours. This multifunction relay reduces inventories and is ideal for maintaining remote installations where stocking several different timing relays would not be practical.

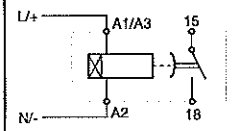
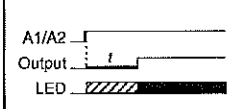
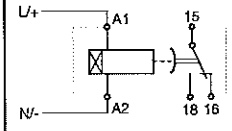
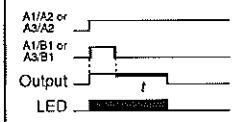
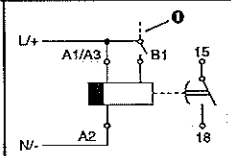
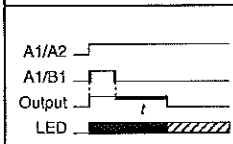
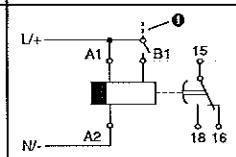
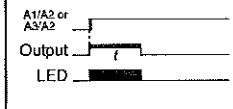
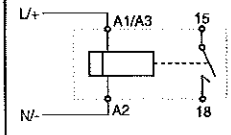
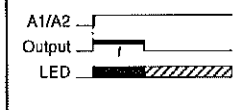
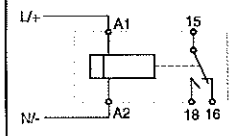
Many safety and convenience features

- Each relay is equipped with an LED that indicates output status conditions.
- Finger and back of hand protection to IP40.
- Terminals are captive and supplied in the open position.
- All RZ7's can be surface mounted, rail mounted, or mounted directly on our family of CA7/CS7 or CA4/CS4 devices.
- RZ7 relays can be mounted in any plane.
- Terminals, setting knob and LED's are all accessible from the front of the unit.
- RZ7-FE Timing Relays are very compact, measuring approximately 1" x 3" x 3".



The RZ7-FEM multifunction timing relay combines all functions in one device.

RZ7-FE Timing Relays – Single Function, One Pole

Functional Description	Functional Diagram	Terminal Arrangement	Type	Catalog Number	Price
ON-Delay Timing Relay (A) When supply voltage is applied, output contact(s) change state after time delay *t*.			• One NO contact • Multi-timing range (from 0.75s to 1h) ❷ • Supply voltage selected via wiring terminals A1, A2 or A3 • LED indicator	**RZ7-FEA1SU22**	50
			• One SPDT contact • Multi-timing range (from 0.05s to 10h) ❷ • "Universal" terminals accept all appropriate supply voltages • Bi-color LED indicator	**RZ7-FEA3TU23**	54
OFF-Delay Timing Relay (B) When control contact B1 closes, the output contact changes state immediately. When control contact B1 opens, the output contact changes state after time delay *t*. Constant supply voltage required on terminals A1/A2 or A3/A2. ***Note:** Control pulse duration minimum 250ms for RZ7-FEB1SU22; 50ms (AC) and 30ms (DC) for RZ7-FEB3TU23.*			• One NO contact • Multi-timing range (from 0.75s to 1h) ❷ • Supply voltage selected via wiring terminals A1, A2 or A3 • LED indicator	**RZ7-FEB1SU22**	54
			• One SPDT contact • Multi-timing range (from 0.05s to 10h) ❷ • "Universal" terminals accept all appropriate supply voltages • Bi-color LED indicator	**RZ7-FEB3TU23**	58
One Shot Relay / Watchdog (D) When supply voltage is applied, the output contact changes state for time period *t*.			• One NO contact • Multi-timing range (from 0.75s to 1h) ❷ • Supply voltage selected via wiring terminals A1, A2 or A3 • LED indicator	**RZ7-FED1SU22**	50
			• One SPDT contact • Multi-timing range (from 0.05s to 10h) ❷ • "Universal" terminals accept all appropriate supply voltages • Bi-color LED indicator	**RZ7-FED3TU23**	54

Supply Voltage

The last three digits in the catalog number represent the supply voltage range the relay will accept:

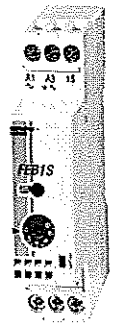
U22	24V AC or DC	(A3/A2)
	110...240V 50/60Hz	(A1/A2)
U23	24...48VDC and 24...240V 50/60Hz	(A1/A2)

Bi-Color LED

Relays with SPDT contacts have bi-color LEDs to indicate function:

▨	LED = green	Supply voltage available
■	LED = red	Output is energized

Timing Ranges	
RZ7-FE with NO contact	**RZ7-FE with SPDT contact**
(15s) 0.75...15 sec (1mn) 0.05...1 min (8mn) 0.4...8 min (1h) 0.05...1 hour	(1s) 0.05...1 sec (10s) 0.5...10 sec (1mn) 0.05...1 min (10mn) 0.5...10 min (1h) 0.05...1 hour (10h) 0.5...10 hours



RZ7-FE timing relay

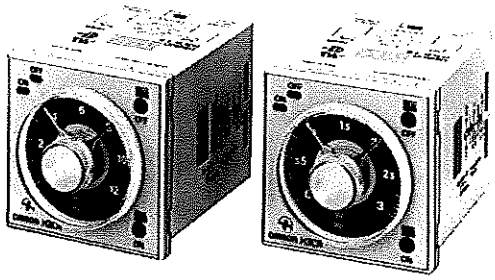
❶ For timing control, a voltage other than the supply voltage can also be used.
❷ Timing range is screwdriver selectable from the faceplate.

OMRON®

Solid-State Repeat-Cycle Timer

H3CR-F

1/16 DIN Solid-State Repeat-Cycle Timer



- Wide power supply ranges of 100 to 240 VAC 24 VAC/VDC, 12VDC
- Combinations of independent long or short ON/OFF time settings are possible
- Fourteen time ranges from 0.05 s to 30 h or 1.2 s to 300 h
- Repeat cycle models with either ON start or OFF start operating functions
- Easy sequence checks through instantaneous outputs for a zero set value at any time range
- 11-pin and 8-pin models are available

Ordering Information

Part number					
	Repeat cycle OFF start	H3CR-F	H3CR-F8	H3CR-F-300	H3CR-F8-300
	Repeat cycle ON start	H3CR-FN	H3CR-F8N	H3CR-FN-300	H3CR-F8N-300
Timing units		0.05 s to 30 h		1.2 s to 300 h	
Terminal form		11-pin models	8-pin models	11-pin models	8-pin models
Supply voltages		100 to 240 VAC, 24 VAC/DC, 12 VDC			
Operating mode		Repeat cycle			

Note: Specify both the model number and supply voltage when ordering.
Example: H3CR-F 24 VAC/DC
Supply voltage

■ MODEL NUMBER LEGEND

H3CR - □ □ □ -□
1 2 3 4

1. Classification
F: Repeat cycle timers

2. Configuration
None: 11-pin socket
8: 8-pin socket

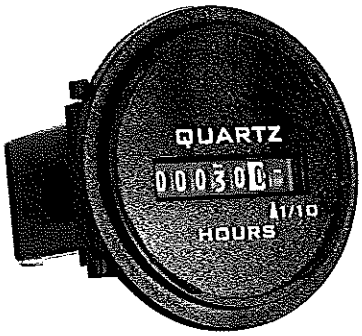
3. Repeat cycle mode
None: OFF start
N: ON start

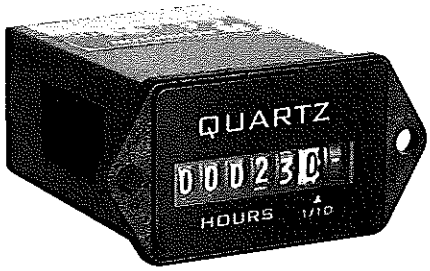
4. Specified Type
300: Long time range (1.2 s to 300 h) type

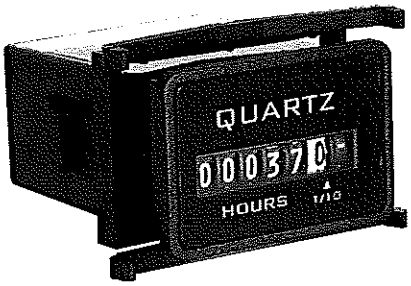
Specifications

Part number		H3CR-F/-F-300	H3CR-F8/-F8-300	H3CR-FN/-FN-300	H3CR-F8N/-F8N-300
Operating mode		OFF start		ON start	
Supply voltage (see note)	AC	100 to 240 VAC (50/60 Hz)			
	AC/DC	24 VAC/DC (50/60 Hz)			
	DC	12 VDC			
Operating voltage range		85% to 110% of rated supply voltage, 90% to 110% with 12-VDC models			
Power consumption	AC	100 to 240 VAC: 10 VA (100 VAC applied)			
	AC/DC	24 VAC/DC: 2 VA (24 VAC applied)/1 W (24 VDC applied)			
	DC	12 VDC: 1 W			
Start, Reset, Gate inputs		ON-impedance: 1 kΩ max. ON residual voltage: 1 V max OFF impedance: 500 kΩ min.			
Control outputs	Type	DPDT relay			
	Max. load	5 A at 250 VAC, p.f. = 1			
	Min. load	10mA at 5 VDC			
Repeat accuracy		±0.3% full scale max. (±0.3% full scale max. ±10 ms in ranges of 1.2 and 3 s)			
Setting error		±5% full scale max ±0.05 s max.			
Resetting system		Time-limit operation/time-limit reset or self-reset			
Resetting time		Minimum power-opening time: 0.1 sec			
Indicators		Output ON indicator (orange LED), output OFF indicator (green LED)			
Materials		Plastic case (light gray Munsell 5Y7/1)			
Mounting		Panel, DIN track, or surface depending on socket selected			
Connections		11-pin round socket	8-pin round socket	11-pin round socket	8-pin round socket
Weight		Approx. 100 g (4.23 oz.)			
Approvals		UL, CSA, CE			
Ambient temperature	Operating	-10° to 55°C (14° to 131°F) with no icing			
	Storage	-25° to 65°C (-13° to 149°F) with no icing			
Humidity		35% to 85%			
Vibration	Mechanical durability	10 to 55 Hz with 0.75-mm single amplitude each in three directions			
	Malfunction durability	10 to 55 Hz with 0.5-mm single amplitude each in three directions			
Shock	Mechanical durability	980 m/s^2 (100G) each in three directions			
	Malfunction durability	98 m/s^2 (10G) each in three directions			
Variation due to voltage change		±0.5% full scale max. (±0.5% full scale max. ±10 ms in ranges of 1.2 and 3 s)			
Variation due to temperature change		±2% full scale max. (±2% full scale max. ±l0 ms in ranges of 1.2 and 3 s)			
Service life	Mechanical	20 million operations min. (under no load at 1,800 operations/h)			
	Electrical	100,000 operations min. (5 A at 250 VAC, resistive load at 1,800 operations/h)			
Insulation resistance		100 MΩ min. (at 500 VDC)			

Note: A power supply with a ripple of 20% max. (single-phase power supply with full-wave rectification) can be used with each DC model.







Description

The Redington Model 722 provides an AC Hour Meter with an operating range of 90-264VAC 50/60 Hz. You no longer require two separate meters, one for 115VAC and one for 230VAC. Models are available in the standard industry housings, 2-Hole Rectangular, Flush-Rectangular, Flush-Round and 3-Hole Round. Its quartz time base insures accurate long-term time keeping. The Totally Sealed case protects against the environment and provides years of reliable service. All models are NEMA 4X, 12 rated when mounted with optional gasket.

Features

- Operating voltage 90-264VAC 50/60Hz
- Totally Sealed
- UL/cUL Recognized, CE & RoHS Compliant
- 6 Figure, 99999.9
- Quartz accuracy

Options

- Wire leads
- Gasket kit (for NEMA 4X, 12 rating)
- Custom lens
- Terminals up, down, straight

Specifications

Figures:	6 - digits, 0.14" [3.6mm] 99999.9 Hours and idicator - white on black Decimal - black on white
Reset:	Non-reset
Voltage:	90-264VAC
Frequency:	50/60Hz
Power:	1 watt max.
Mounting:	Clip or mounting holes
Termination:	¼" [6.3mm] spade terminals
Weight:	~2 oz [57 g]
Accuracy:	± 0.02% over entire range

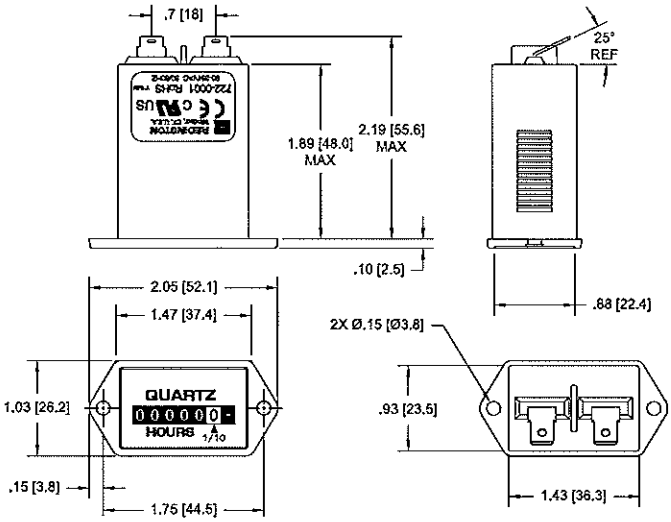
Case Material:	Black polymer
Lens Material:	Polymer
Agency Approvals:	UL/cUL Recognized, CE & RoHS Compliant, SAE & NEMA 4X, 12 Compliant
Environmental:	Totally Sealed
Front Panel:	NEMA 4X, 12 rated with optional gasket
Temperature:	-40°F to +185°F [-40°C to + 85°C]
Humidity:	95% (SAE J1378)
Vibration:	10-80 Hz. 20g max. (SAE J1378)
Shock:	55g @ 9 - 13msec (SAE J1378)

Models	Description
722-0001	2-Hole Rectangular, 90-264VAC 50/60Hz, ¼" [6.3mm] spade terminals, hours & 1/10's
722-0002	Flush-Rectangular, 90-264VAC 50/60Hz, ¼" [6.3mm] spade terminals, hours & 1/10's
722-0003	Flush-Round 90-264VAC 50/60Hz ¼" [6.3mm] spade terminals hours & 1/10's
722-0004	3-Hole Round, 90-264VAC 50/60Hz, ¼" [6.3mm] spade terminals, hours & 1/10's
5003-009	NEMA 4X, 12 Gasket for Model 722-0002
5003-010	NEMA 4X, 12 Gasket for Model 722-0001
5003-011	NEMA 4X, 12 Gasket for Model 722-0004
5003-012	NEMA 4X, 12 Gasket for Model 722-0003

* All items are normally in factory stock

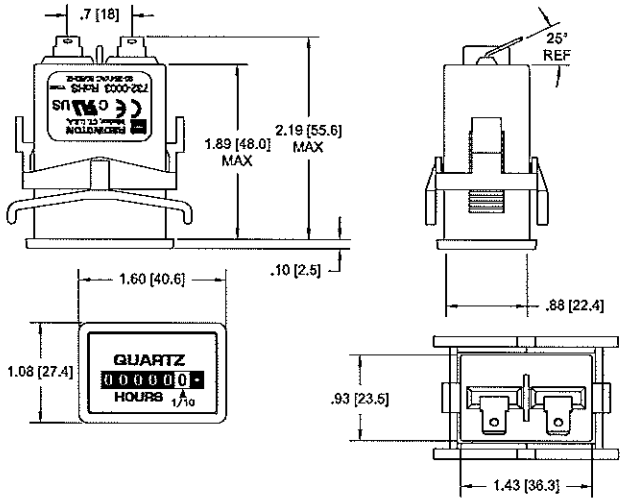
Dimensions

2-Hole



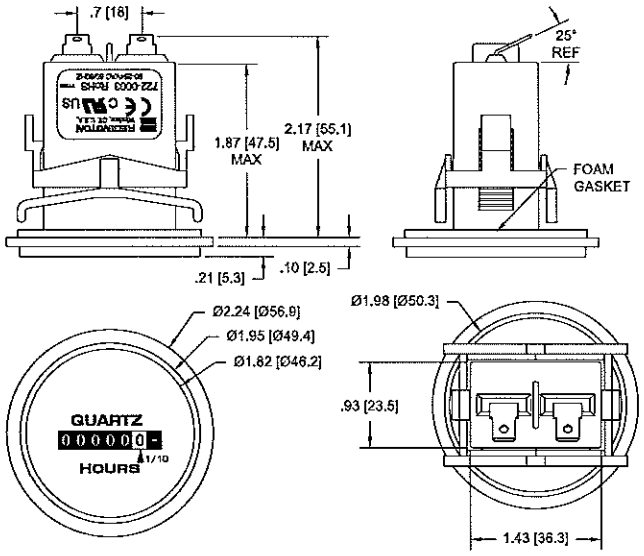
Panel Opening: 1.45" X 0.95" [36.8 X 24.1]

Flush-Rectangular



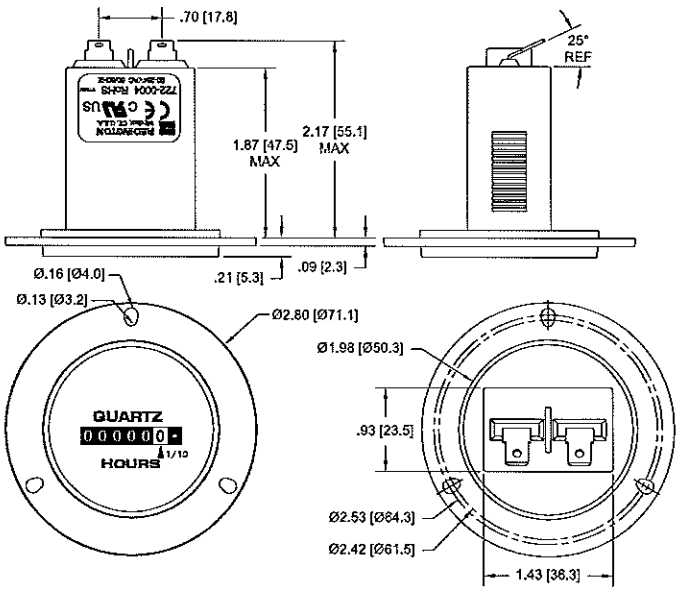
Panel Opening: 1.45" X 0.95" [36.8 X 24.1]
Panel Thickness: 0.03 to 0.63 [0.76 to 16.00]

Flush-Round



Panel Opening: 2.0" [50.6]
Panel Thickness: 0.40 [10.2] Max.

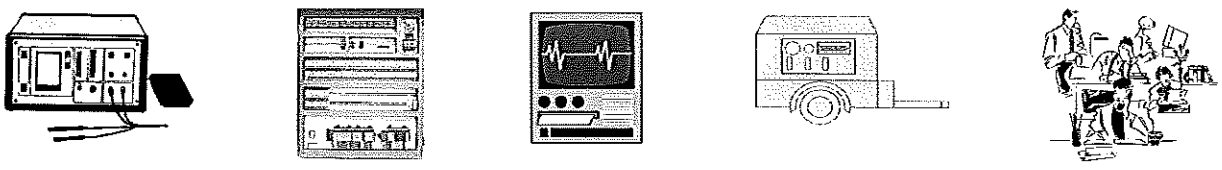
3-Hole Round



Panel Opening: 2.0" [50.6]

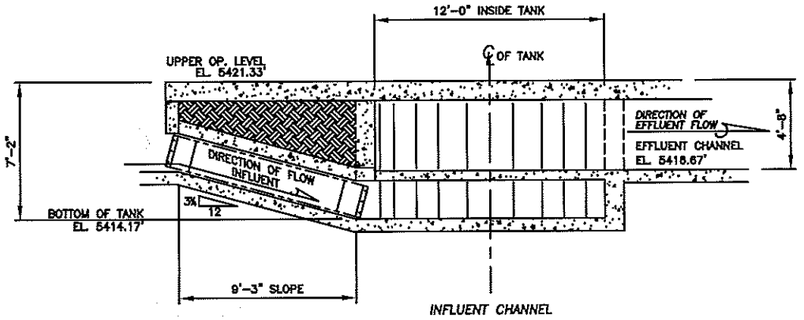
Applications

Medical Equipment | Control Panels | Test Equipment | Generators | Office Equipment

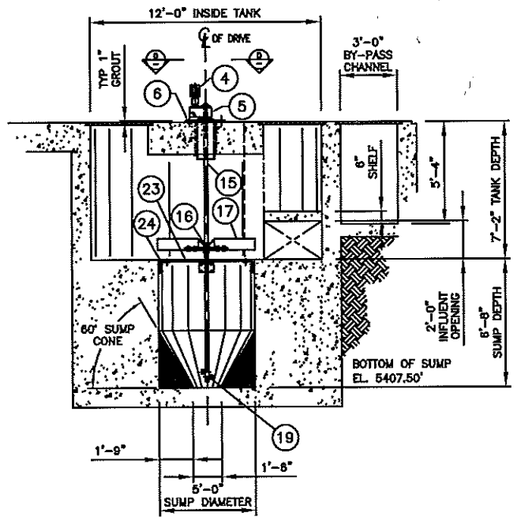


SECTION V

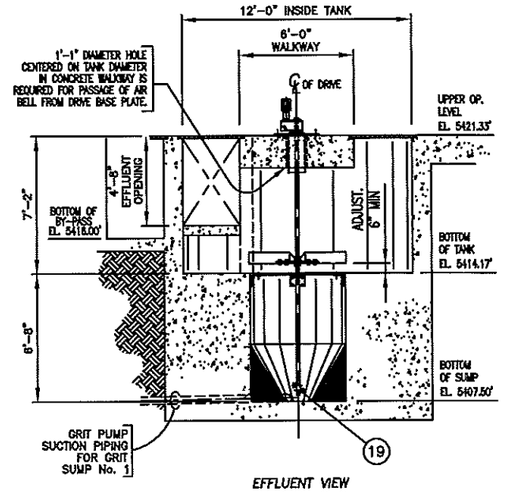
DRAWINGS



INFLUENT CHANNEL
SECTION A–A

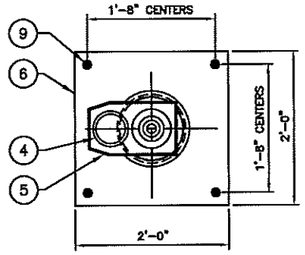


INFLUENT VIEW
SECTION B–B
VIEW ROTATED 90° – CW

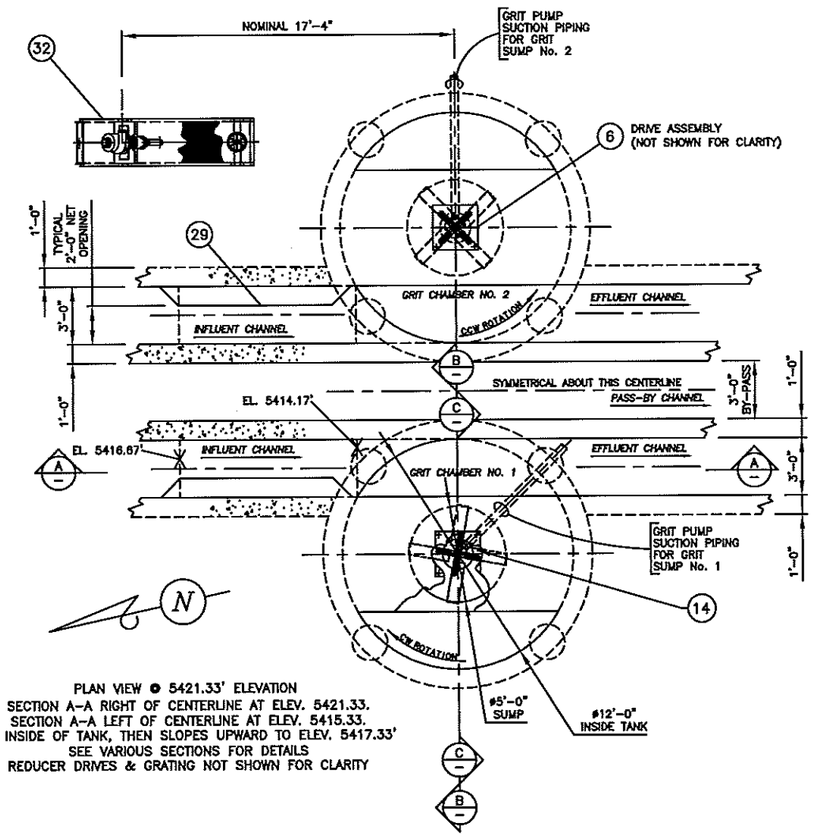


EFFLUENT VIEW
SECTION C–C
VIEW ROTATED 90° – CCW

REFER TO PLAN VIEW FOR ACTUAL PIPING ORIENTATION OF PUMP SUCTION EMBEDDED PURGE PIPING



VIEW D–D
ENLARGED 4x VIEW FOR CLARITY



PLAN VIEW ⊙ 5421.33' ELEVATION
SECTION A–A RIGHT OF CENTERLINE AT ELEV. 5421.33.
SECTION A–A LEFT OF CENTERLINE AT ELEV. 5415.33.
TO INSIDE OF TANK, THEN SLOPES UPWARD TO ELEV. 5417.33'
SEE VARIOUS SECTIONS FOR DETAILS
REDUCER DRIVES & GRATING NOT SHOWN FOR CLARITY

MATERIAL LIST

IDENTIFICATION GROUP	PIECE	QUAN.	SPECIFICATION DWG. OR PART NO.	NAME, DESCRIPTION, MATERIAL	REFERENCE	SYM-BOL
	1	TWO		FORCED VORTEX GRIT COLLECTOR (1) CW AND (1) CCW	TTL EA. 1,157 LBS	
				EACH CONSISTING OF THE FOLLOWING:	2,314 LBS BOTH	
	3	ONE	.03	DRIVE ASSEMBLY	195 LBS	
	4	1		MOTOR, 1.5 HP, 1800 RPM, 230/460V-60-3, XP		
	5	1		SPEED REDUCER		
	6	1		DRIVE BASE WITH AIR BELL	A-36 STEEL	
	7	1		TUBE, CAULK	SILICONE	
	8	LOT		ASSEMBLY FASTENER	STAINLESS STEEL	
⟨8⟩	9	*4		EPOXY ANCHOR, 5/8" X 6" LG	18-8 SST	
	14	ONE	.02	IMPELLER ASSEMBLY, NOMINAL 60" DIA		
	15	1	NOTE 8	SHAFT	C1045	
	16	1		HUB	A36	
	17	1	NOTE 8	ADJUSTABLE IMPELLER BLADE	A36	
	18	LOT		ASSEMBLY FASTENER	18-8 SST	
	19	1	NOTE 8	GRIT LIFT VANE	A36	
	22	ONE	.03	GRIT CHAMBER FLOOR PLATE ASSEMBLY		
	23	1		FLOOR PLATE, 1/4" THICK (2-PIECE)	A36	
	24	4		SUPPORT BRACKETS	A36	
	25	LOT		ASSEMBLY FASTENERS	18-8 SST	
⟨8⟩	26	*16		EPOXY ANCHOR BOLT, 1/2" X 7"	18-8 SST	
	29	ONE		INLET BAFFLE	A36	
⟨8⟩	30	*6		EPOXY ANCHOR, 1/2" X 7"	18-8 SST	
	32	ONE		12 SW GRIT WASHER – REF TO SEE DWG. 1757-11-C1		
	34	TWO		GRIT PUMP		
	35			ELECTRICAL CONTROL, PER SCHLOSS DWGS A2 & A3		
	37			OPERATION AND MAINTENANCE MANUALS		

GENERAL NOTES:

1. SURFACE PREPARATION, PAINTING AND PROTECTIVE COATINGS
   A. FABRICATED STEEL–NON IMMERSION: COMMERCIAL BLAST CLEAN SSPC–SP6 FOR SYSTEM 68–1 THEMEC PAINT
      PRIME COAT: 68–1211 3.0–5.0 MILS DFT
      FINISH COAT: BY OTHERS
   B. FABRICATED STEEL, IMMERSION: COMMERCIAL BLAST CLEAN SSPC–SP10 FOR SYSTEM 68–1 THEMEC PAINT
      PRIME COAT: 68–1211 3.0–5.0 MILS DFT
      FINISH COAT: BY OTHERS
   C. ITEMS NOT TO BE PAINTED: GALVANIZED STEEL, STAINLESS STEEL, MACHINED SURFACES, FINISHED ITEMS
   D. MACHINED SURFACES SHALL BE COATED WITH PROTECTIVE FILM OR GREASE AS DETERMINED BY SERVICE
2. GROUTING OF EQUIPMENT TO BE DONE ONLY AFTER ALIGNMENT IS COMPLETED AND TEST RUN IS PERFORMED.
3. EQUIPMENT LABOR AND MATERIALS FURNISHED BY OTHERS UNLESS OTHERWISE SPECIFIED (I.E. NOT BY SCHLOSS ENGINEERED EQUIP.) UNLOADING, INSTALLATION & ERECTION, PIPING & WIRING, GROUT & GROUTING, MOTOR STARTERS & CONTROLS, SAFETY GUARDS OTHER THAN THOSE PROVIDED, ACCESS PLATFORMS & LADDERS AND ALL WARNING SIGNS INCLUDING BUT NOT LIMITED TO THE FOLLOWING:
   "DO NOT PUT HANDS OR TOOLS IN MOVING MACHINERY" AND
   "CAUTION THIS MACHINE CONTROLLED AUTOMATICALLY AND MAY START ANYTIME."
4. ALL LUBRICANTS TO BE FURNISHED BY OTHERS TO SUIT LOCAL CONDITIONS PER INSTALLATION INSTRUCTIONS.
5. THIS DRAWING IS THE PROPERTY OF SCHLOSS ENGINEERED EQUIPMENT, INC. USE OF THIS DRAWING OR ANY INFORMATION THEREON FOR OTHER THAN ITS INTENDED PURPOSE IS EXPRESSLY PROHIBITED.
6. CAUTION: THIS EQUIPMENT MUST BE ASSEMBLED, OPERATED AND MAINTAINED IN ACCORDANCE WITH THE SERVICE INSTRUCTIONS. FAILURE TO DO SO MAY RESULT IN SERIOUS PERSONAL INJURY AND/OR PROPERTY DAMAGE. ADDITIONAL COPIES OF THE SERVICE INSTRUCTIONS ARE AVAILABLE FROM SCHLOSS ENGINEERED EQUIPMENT, INC.
7. PIPING AND ALL SUPPORTS BY OTHERS. REFER TO PLAN VIEW FOR PREFERRED ORIENTATION OF GRIT PUMP SUCTION AND WATER PURGE LINE. FINAL ORIENTATION BY OTHERS.
8. THE PITCH OF THE GRIT LIFT VANE MUST BE THE SAME PITCH DIRECTION AS THE PITCH DIRECTION OF TURBINE BLADES. THE PITCH DIRECTION FOR BOTH THE TURBINE BLADES AND THE GRIT LIFT VANE MUST LIFT THE GRIT IN AN UPWARD DIRECTION.

⟨8⟩ *#3. INDICATES THAT GENERAL CONTRACTOR SHALL PROVIDE THESE ITEMS, IN LIEU OF SCHLOSS ENGINEERED EQUIPMENT.*

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January 13, 2012

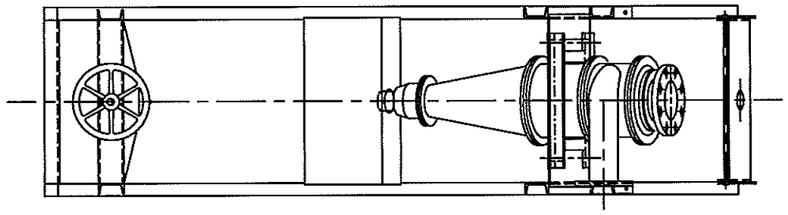
REVISED
DESTROY PREVIOUS PRINTS
January 13, 2012

TITLE: TYPE: (2) 12 CPT FORCED VORTEX GRIT COLLECTOR			
12'-0" DIAMETER	⟨B⟩	1/13/12	ADD NOTE 9 – CONTRACTOR PROVIDED PCS.
GENERAL ARRANGEMENT AND ASSEMBLY	⟨B⟩	1/13/12	EQUIPMENT SHOWN REFLECTS "AS-BUILT"
FOR: HAROLD D. THOMPSON RWRF, FOUNTAIN, CO	⟨A⟩	9/29/11	REV PER ENGR'S COMMENTS
ENGINEER: GMS, INC., COLORADO SPRINGS, CO	REV.	DATE	DESCRIPTION OF REVISION
DRAWN: GTW CHECKED: APPROVED: CMS	REFERENCE		
DATE: 7/11/11	SCHLOSS ENGINEERED EQUIPMENT, INC. AURORA, COLORADO		1757–11–A1
SCALE: 1/4"=1'-0"			

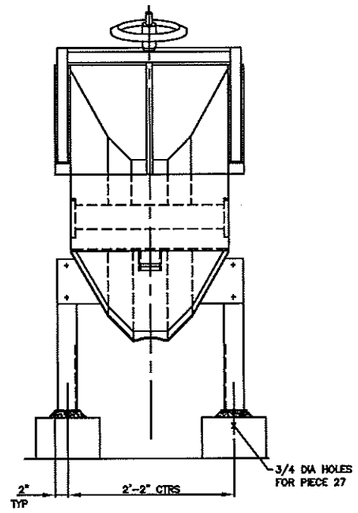
Form 88233AA 10/11

GENERAL NOTES:

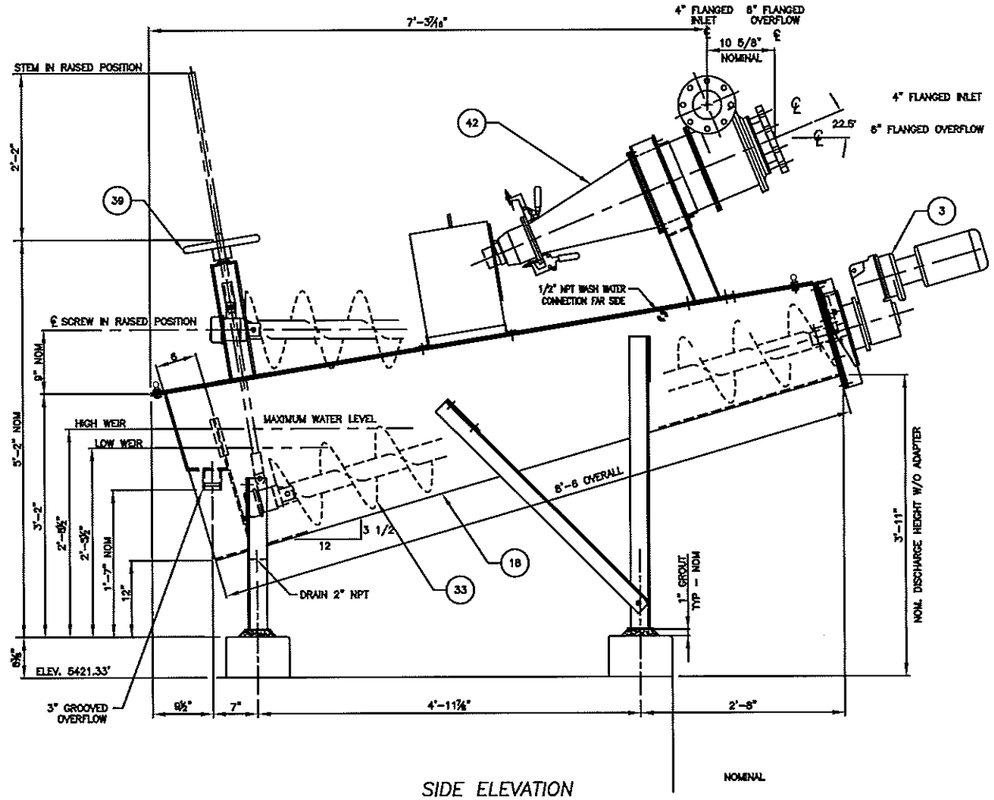
1. SURFACE PREPARATION, PAINTING AND PROTECTIVE COATINGS
   A. FABRICATED STEEL–NON IMMERSION: COMMERCIAL BLAST CLEAN SSPC–SP6 FOR SYSTEM 68–1 THEMEC PAINT
      PRIME COAT: 68–1211 EPOXY PRIMER 3–5, MINISH COAT: IN FIELD BY OTHERS
   B. FABRICATED STEEL, IMMERSION SERVICE: COMMERCIAL BLAST CLEAN SSPC–SP10 FOR SYSTEM 68–1 THEMEC PAINT
      PRIME COAT: 68–1211 EPOXY PRIMER 3–5, MINISH COAT: IN FIELD BY OTHERS
   C. SCREW, IF DIFFERENT FROM 1.A.: BLAST AND PAINT PER SS–SP10 AND COAT WITH BITUMASTIC 300, 8–10 MIL DFT
   D. ITEMS NOT TO BE PAINTED: GALVANIZED STEEL, STAINLESS STEEL, MACHINED SURFACES, FINISHED ITEMS
   E. MACHINED SURFACES SHALL BE COATED WITH PROTECTIVE FILM OR GREASE AS DETERMINED BY SERVICE
2. GROUTING OF EQUIPMENT TO BE DONE ONLY AFTER ALIGNMENT IS COMPLETED AND TEST RUN IS PERFORMED.
3. EQUIPMENT LABOR AND MATERIALS FURNISHED BY OTHERS UNLESS OTHERWISE SPECIFIED,
   (I.E. NOT BY SCHLOSS ENGINEERED EQUIP.) UNLOADING, INSTALLATION & ERECTION, PIPING & WIRING,
   GROUT & GROUTING, MOTOR STARTERS & CONTROLS, SAFETY GUARDS OTHER THAN THOSE PROVIDED,
   ACCESS PLATFORMS & LADDERS AND ALL WARNING SIGNS INCLUDING BUT NOT LIMITED TO THE FOLLOWING:
   "DO NOT PUT HANDS OR TOOLS IN MOVING MACHINERY" &
   "CAUTION, THIS MACHINE CONTROLLED AUTOMACTICALLY AND MAY START ANYTIME."
4. ALL LUBRICANTS TO BE FURNISHED BY CONTRACTOR TO SUIT LOCAL CONDITIONS PER
   INSTALLATION INSTRUCTIONS.
5. THIS DRAWING IS THE PROPERTY OF SCHLOSS ENGINEERED EQUIPMENT, INC. USE OF THIS DRAWING
   OR ANY INFORMATION THEREON FOR OTHER THAN ITS INTENDED PURPOSE IS EXPRESSLY PROHIBITED.
6. PRESSURE GAUGE TO BE INSTALLED IN PIPE FLANGE UPSTREAM OF CYCLONE INLET – BY OTHERS
7. CONTRACTOR TO PROVIDE VENT PIPING TO ATMOSPHERE ON OVERFLOW PIPING OF CYCLONE. ← *PLEASE NOTE*



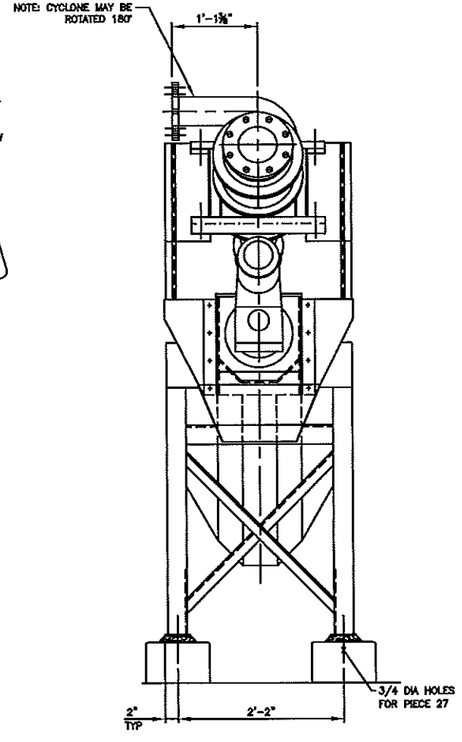
PLAN VIEW
DRIVE OMITTED FOR CLARITY



OVERFLOW END ELEVATION



SIDE ELEVATION



DISCHARGE END ELEVATION

MATERIAL LIST

IDENTIFICATION GROUP	PIECE	QUANTITY	SPECIFICATION DWG. OR PART NO.	NAME, DESCRIPTION, MATERIAL	REFERENCE	SYMBOL
	1	ONE		TYPE 12SW–CL GRT WASHER, 12" DIA X 8'–0"	EST TTL 1585 LBS	
				EACH MACHINE CONSISTS OF THE FOLLOWING:		
	3	ONE		DRIVE ASSEMBLY	140 LBS	
	4	1		MOTOR, 1/2 HP, 1725 RPM, 3–60–230/460		
				FRAME 56, TEFC, EXP PROOF		
	6	1		REDUCER		
	13	1		PIVOT PLATE	A36	
	14	2		PIVOT PLATE SUPPORT BRACKET	A36	
	15	1		PIVOT SHAFT	304 SST	
	18	ONE		TANK ASSEMBLY	702 LBS	
	19	1		TANK W/FLARED SIDES, OPEN END DISCHARGE AND	A36	
				INTEGRAL OVERFLOW, 1/4" THK PLATE,		
	21	1		OVERFLOW, 3" GOE	A36	
	22	1		TANK DRAIN, 2" NPT	A36	
	23	1		TANK SUPPORT, DISCHARGE END	A36	
	24	2		SUPPORT BRACE, OVERFLOW END	A36	
	25	2		SUPPORT BRACE, DISCHARGE END	A36	
	26	2		SUPPORT LEG, OVERFLOW END	A36	
	27	4		EPOXY ANCHOR, 5/8" X 7" LG – BY OTHERS	304 SST	
	28	LOT		BOLTED EXPANDED METAL COVERS	304 SST	
	30	4		EYE BOLT		
	32	ONE		GRT SCREW ASSEMBLY	205 LBS	
	33	1		SECTIONAL SCREW, 12" DIA., 3/16" THK FLIGHTS,		
				RIGHT HAND FLIGHTS, 50% PITCH	A36	
	35	4		COUPLING BOLTS	304 SST	
	36	SET		WEAR SHOES, AR W/STAINLESS STEEL CSK BOLTS		
	37	1		SEALED LOWER BEARING ASSEMBLY		
	39	ONE		LIFTING DEVICE ASSEMBLY WITH HAND WHEEL	51 LBS	
	40	1		STRUCTURAL SUPPORT		
	41	1		THREADED ROD WITH HARDWARE		
	44	ONE		SEWAGE DEGRITTING ASSEMBLY	465 LBS	
	45	1		CYCLONE, KREBS D10LB–845 COMPLETE WITH GUM		
				RUBBER LINERS, 4" VORTEX FINDER, 2" DIA		
				ADJUSTABLE APEX, 4" FLG. INLET, 6" FLG. OVERFLOW		
	48	1		PRESSURE GAUGE AND DIAPHRAGM ASSEMBLY		
	49	1		VALVE, SOLENOID, 120V, N.C., 3/8" NPT, NEMA 7	BRONZE	
	50	1		VALVE, GLOBE, 3/8" NPT	BRONZE	
	51	1		CYCLONE SUPPORT	A36	
	52	1		CYCLONE DISCHARGE SPLASH BOX	304 SST	
	54	LOT		ASSEMBLY FASTENERS	18–8 SST	
	56	1		WASH WATER CONNECTION, 1/2" NPT, SCH 40	A36	
	60	LOT		SPARE PARTS:	21 LBS	
	61	1 SET		SEALS FOR REDUCER		
	62	1		LOWER BEARING ASSEMBLY		

REVISED
DESTROY PREVIOUS PRINTS
January 13, 2012

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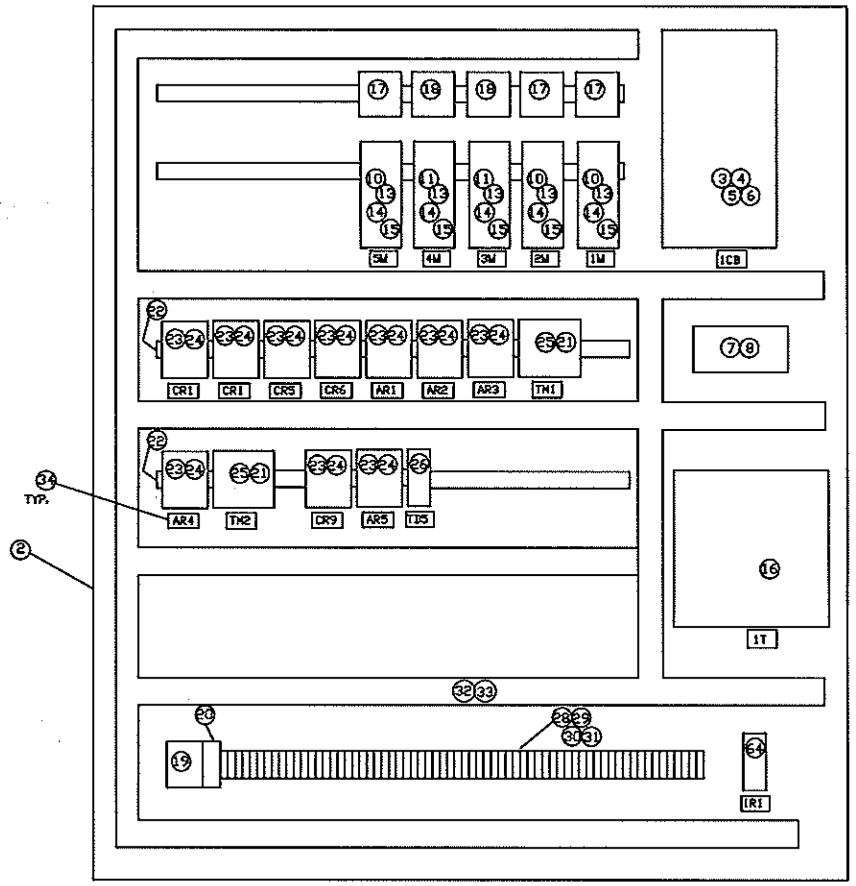
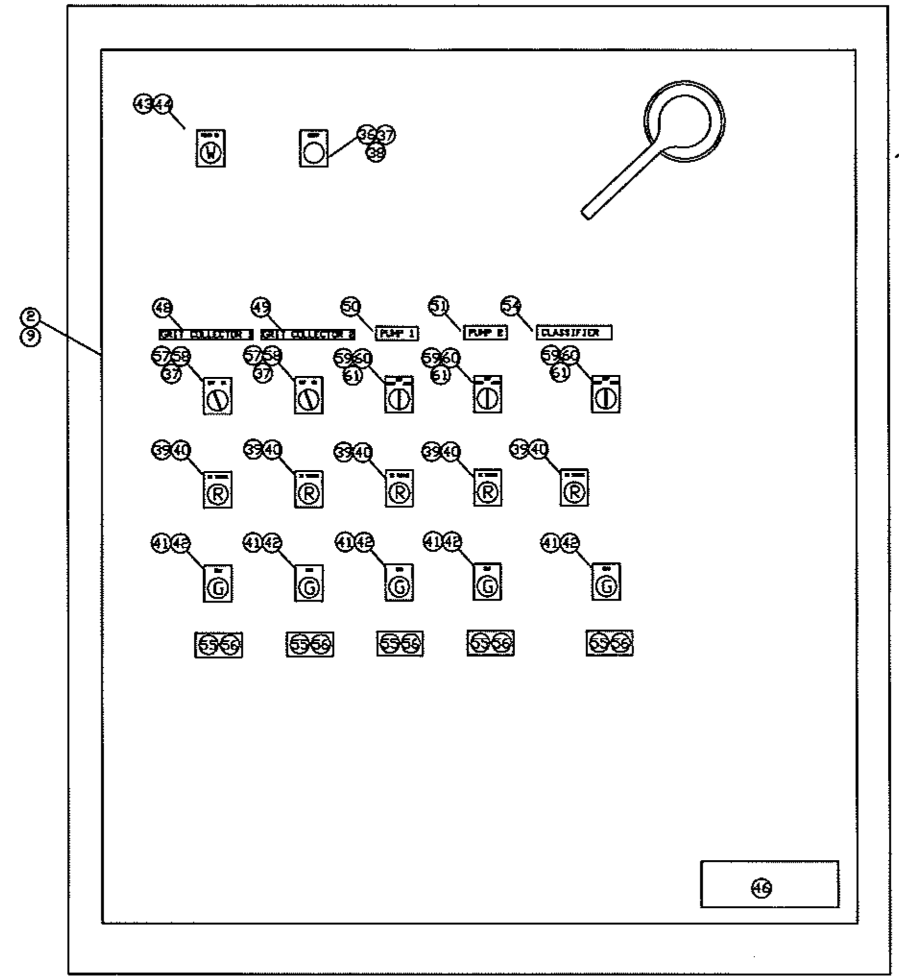
January 13, 2012

TITLE 12" DIA SW–CL – GRIT CLASSIFIER/WASHER		
	6 1/13/12	EQUIPMENT SHOWN REFLECTS "AS–BUILT"
GENERAL ARRANGEMENT AND ASSEMBLY	5 1/13/12	ADDED WEIGHTS TO BILL OF MATERIAL
FOR: HAROLD D. THOMPSON RWRF, FOUNTAIN, CO	4 9/29/11	REV ELEV'S, DISCHG SUPPORT
ENGINEER: GMS, INC. – COLORADO SPRINGS, CO	NO. DATE	DESCRIPTION OF REVISION
DRAWN GTW CHECKED KAS APPROVED CMS	REFERENCE	
DATE 7/13/11 SCALE 1"=1'–0"	SCHLOSS ENGINEERED EQUIPMENT, INC. AURORA, COLORADO — U.S.A.	DRAWING No. 1757–11–C1

1757-11-C1.dgn

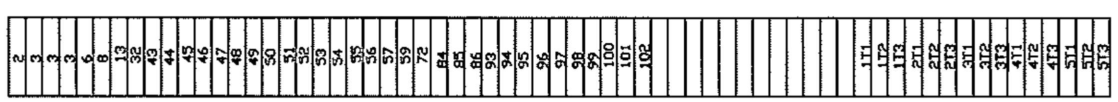


REAR SUB-PANEL



PANEL DOOR

TERMINAL DETAIL



MATERIAL LIST

ITEM	QTY	DESCRIPTION	MANUFACTURER	PART NUMBER
1	1	ENCLOSURE, NEMA 4/12/13, 48x36x12	SAGINAW	SCE-48H3612LP
2	1	SUB-PANEL, 45x33	SAGINAW	SCE-48P36
3	1	CIRCUIT BREAKER, 600V, 45A, 25KAIC	ABB	S3N0045TW
4	1	CB OPERATOR, NEMA 4/4X	ABB	K5VD-H
5	1	CB HANDLE, NEMA 4/4X	ABB	OHB95L10
6	1	CB OPERATOR SHAFT	ABB	OXP10X225
7	1	POWER DIST. BLOCK, 3P, 6/COND	FERRAZ	67536
8	3	POWER DIST. BLOCK SAFETY COVER	FERRAZ	08570
9		NOT USED		
10	3	NON-REV CONTACTOR, 9A, 120V	S+S	CA7-9-10-120
11	2	NON-REV CONTACTOR, 12A, 120V	S+S	CA7-12-10-120
12	3	SS OVERLOAD RELAY, 1.0-5.0A	S+S	CEP7-EECB
13	2	SS OVERLOAD RELAY, 3.2-16A	S+S	CEP7-EEDB
14	5	JAM PROTECTION REMOTE RESET MODULE	S+S	CEP7-EJM
15	5	AUX. CONTACTS, 2NO, TOP MTD.	S+S	CA7-PV-20
16	1	TRANSFORMER, 208/230/460, PRI		
		24/115V SEC., 500VA,	MICRON	B500-2008-BF
17	3	MIN. CIRCUIT BREAKER, 3P, 460V, 4A	ABB	S203-K4
18	2	MIN. CIRCUIT BREAKER, 3P, 460V, 20A	ABB	S203-K20
19	1	MIN. CIRCUIT BREAKER, 2P, 460V, 2A	ABB	S202-K2
20	1	MIN. CIRCUIT BREAKER, 1P, 460V, 5A	ABB	S201-K5
21	2	SOCKET, 8 PIN	IDEC	SR2P-06
22	1	DIN MOUNTING RAIL	IDEC	BNDN-1000
23	10	CONTROL RELAY, 4PDT	IDEC	RH4B-U-AC120V
24	10	SOCKET, 4 POLE	IDEC	SH4B-05
25	2	REPEAT CYCLE TIMER, 8 PIN	OMRON	H3CR-F8-AC120
26	1	OFF TIME DELAY RELAY	S+S	RZ7-FEB3TU23
27		NOT USED		
28	60	TERMINAL BLOCK, 600V, 50A, 8MM	SQUARE D	AB1VV635U
29	2	TERMINAL END COVER	SQUARE D	AB1AC6
30	4	TERMINAL END BRACKET	SQUARE D	AB1AB8M35
31	6	MARKING STRIP, BLANK, 1 CARD, WHITE, 8MM	WIELAND	Z4.242.6053.0
32	2	WIRING DUCT, 1"Wx3"hx6'L	PANDUIT	E1X3LG6
33	2	WIRE DUCT COVER, 1"Wx6'L	PANDUIT	C1LG6
34#	22	NAMEPLATE, 1/2"H x 1/4"LETTERS, 1EA		
		'1CB','1M','2M','3M','4M','5M'		
		'1T','AR1','AR2','AR3','AR4','AR5'		
		'CR1','CR2','CR5','CR6'		
		'CR9','TD2','TD4','TD5',		
		'TM1','TM2',		
35		NOT USED		
36	1	22MM, PB OPERATOR, BLACK	SQUARE D	XB4BA21
37	3	22MM, MOUNTING BASE, W/ 1NO-1NC	SQUARE D	ZB4BZ105
38	1	22MM, LEGEND PLATE, 'RESET'	SQUARE D	ZBY2322
39	6	22MM, ILL PB, RED LED 115V, 1NO, 1NC	SQUARE D	XB4BV34G5
40*	5	22MM, LEGEND PLATE, 'HIGH TORQUE'	SQUARE D	ZBY2101
41	5	PILOT LIGHT, 120VAC, LED, PRES-TEST, GRE	SQUARE D	9001-SKT38LGG31
42	5	22MM, LEGEND PLATE, 'RUN'	SQUARE D	ZB4BY2334
43	1	22MM, PILOT LIGHT, WHITE, LED, 115VAC	SQUARE D	XB4BVG1
44	1	22MM, LEGEND PLATE, 'POWER ON'	SQUARE D	ZBY2326
45	1	22MM, LEGEND PLATE, 'FAULT'	SQUARE D	ZBY2101
46#	1	NAMEPLATE, 1 3/4"Hx8"Wx1/4 LETTERS:		
		'GRIT SYSTEM'		
		'SERIAL NO. 1757-11'		
		'SCHLOSS ENGINEERED EQUIPMENT, INC.'		
47	5	NEMA 7, 1 HOLE, 'PULL START/PUSH STOP'	AKRON	CXI333-X1-B7-N6
48#	1	NAMEPLATE 1/2Hx1 1/2Wx1/4 LETTERS	GRIT COLLECTOR 1'	
49#	1	NAMEPLATE 1/2Hx1 1/2Wx1/4 LETTERS	GRIT COLLECTOR 2'	
50#	1	NAMEPLATE 1/2Hx1 1/2Wx1/4 LETTERS	'PUMP 1'	
51#	1	NAMEPLATE 1/2Hx1 1/2Wx1/4 LETTERS	'PUMP 2'	
52#		NOT USED		
53#		NOT USED		
54#	1	NAMEPLATE 1/2Hx1 1/2Wx1/4 LETTERS	'CLASSIFIER'	
55	5	ELAPSED TIME METER, NEMA 12	REDDINGTON	722-0004
56	5	ELAPSED TIME METER, NEMA 4X GASKET	REDDINGTON	5003-11
57	2	22MM, 2 POS MAINTAINED SEL. SWITCH	SQUARE D	ZB4BD2
58	2	LEGEND PLATE, 'OFF ON'	SQUARE D	9001-KN144BP
59	3	22MM, 3 POSITION MAINTAINED SEL. SW	SQUARE D	ZB4BD3
60	3	22MM, MTG BASE, W/ 2 NO CONTACTS	SQUARE D	ZB4BZ1034
61	3	22MM, LEGEND PLATE, 'HAND-OFF-AUTO'	SQUARE D	ZBY2387
62	5	PUSH-PULL PADLOCKING COVER	ALLEN-BRADLEY	800H-NP4
*		CUSTOM ENGRAVED LEGEND PLATE PER MANUFACTURER'S SPECIFICATIONS		
#		ALL NAMEPLATES TO BE BLACK LAMINATED PLASTIC WITH WHITE LETTERS		

GENERAL NOTES

1. ALL CONTROL WIRING TO BE 14GA STRANDED WITH WIRE NUMBERS EACH END.
2. "□" DENOTES TERMINALS, '- - -' DENOTES EXTERNAL WIRING, AND "○" DENOTES TERMINALS ON DEVICES NOTED.
3. CONTROL PANEL WIRING TO BE COMPLETELY TESTED AND ALL CORRECTIONS MADE PRIOR TO SHIPMENT. PANEL FABRICATOR TO RETURN ONE (1) PRINT FOR EACH DRAWING WITH 'AS-BUILT' MARK-UPS ALONG WITH COMPONENT INSTRUCTIONS TO SCHLOSS ENGINEERED EQUIPMENT, INC.

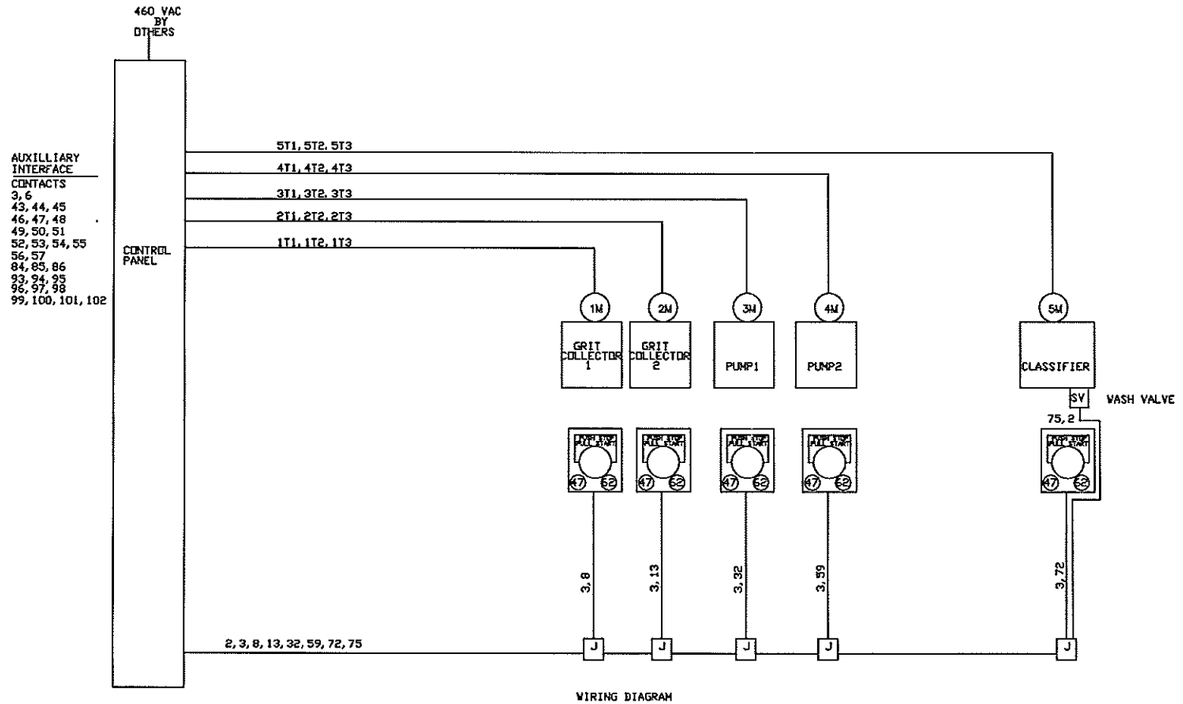
TITLE: GRIT SYSTEM
FOUNTAIN, CO
ELECTRICAL CONTROL SYSTEM SHT. 1 OF 4
FILE: 1757A2

REV.	DATE	DESCRIPTION OF REVISION
B	4/3/12	AS BUILT
A	1/26/12	REMOVE CLASSIFIER ZERO SPEED

DRAWN: JT | CHECKED: | APPROVED: | REFERENCE:
DATE: 8/5/11 | SCALE: NTS

SCHLOSS ENGINEERED EQUIPMENT, INC. AURORA, COLORADO

1757-11-A2



WIRING DIAGRAM

CONFIDENTIAL

TITLE GRIT SYSTEM			
FOUNTAIN, CO			
	4	4/2/12	AS BUILT
ELECTRICAL CONTROL SYSTEM SHT. 2 OF 4	3	1/26/12	REMOVE CLASSIFIER ZERO SPEED
FILE: 1757A3	REV.	DATE	DESCRIPTION OF REVISION
DRAWN JT / CHECKED / APPROVED	REFERENCE		
DATE 8/5/11	SCHLOSS ENGINEERED EQUIPMENT, INC. AURORA, COLORADO		1757-11-A3
SCALE NTS			

FORM: BEDD34A

460VAC BY OTHERS

A L1
B L2
C L3

1CB 45A

CB2 2A LL3 LL1 1T

CB3 SA CB3

1MCP, 4A — 1L1 1L2 1L3 — 1M — 1T1 1T2 1T3 — GRIT COLLECTOR 1, 1.5 HP DRIVE MOTOR, 2.6 FLA

2MCP, 4A — 2L1 2L2 2L3 — 2M — 2T1 2T3 2T13 — GRIT COLLECTOR 2, 1.5 HP DRIVE MOTOR, 2.6 FLA

3MCP, 20A — 3L1 3L2 3L3 — 3M — 3T1 3T2 3T3 — PUMP1, 7.5 HP DRIVE MOTOR, 10.8 FLA

4MCP, 20A — 4L1 4L2 4L3 — 4M — 4T1 4T2 4T3 — PUMP2, 7.5 HP DRIVE MOTOR, 10.8 FLA

5MCP, 4A — 5L1 5L2 5L3 — 5M — 5T1 5T2 5T3 — CLASSIFIER, 0.5 HP DRIVE MOTOR, 1.0 FLA

POWER ON (W)

RESET 5

CR2 — 1-48, 2-125 OVERLOAD RESET
CR1 — 1-48

M1 OVERLOAD RESET — CR1 14 15
M2 OVERLOAD RESET — CR1 16 17
M3 OVERLOAD RESET — CR1 18 19
M4 OVERLOAD RESET — CR1 20 21
M5 OVERLOAD RESET — CR2 22 23

SCADA SHUTDOWN 6 — CR6, CR5 — 2-208; 1-112, 1-124, 1-134, 2-10

1DL 7 — AR1 — HI TORQUE — 1-153, 1-155

PUSH STOP PULL START — CR5 8 9 — OFF ON — GRIT COLLECTOR 1 — 1M 10 — 1DL — 1-01, 1-02, 1-03, 1-118, 1-150

1M 11 — RUN (R) — ETM

2DL 12 — AR2 — HI TORQUE — 1-153, 1-155

PUSH STOP PULL START — CR5 13 24 — OFF ON — GRIT COLLECTOR 2 — 2MF 25 — 2DL — 1-08, 1-09, 1-10, 1-129, 1-150

2M 26 — RUN (R) — ETM

3DL 34 — HI TORQUE (A) — AR3 — 1-153, 1-155

PUSH STOP PULL START — CR5 32 33 — OFF HAND AUTO 35 36

3M 37 — RUN (R) — PUMP1 3M — 3DL — 1-15, 1-16, 1-17, 1-136, 2-113, 1-150 — ETM

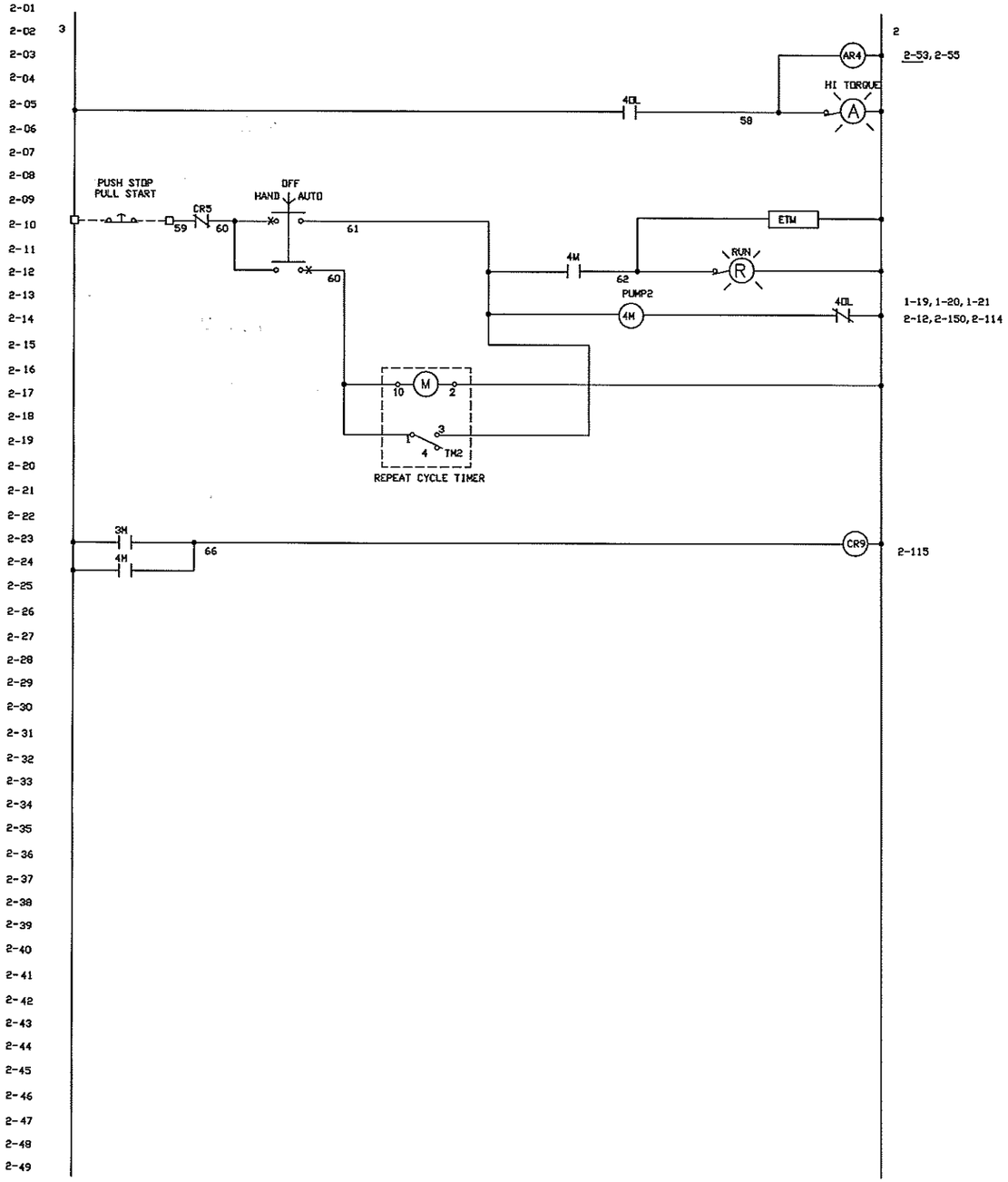
M 10 2 — 3 4 TM1 — REPEAT CYCLE TIMER

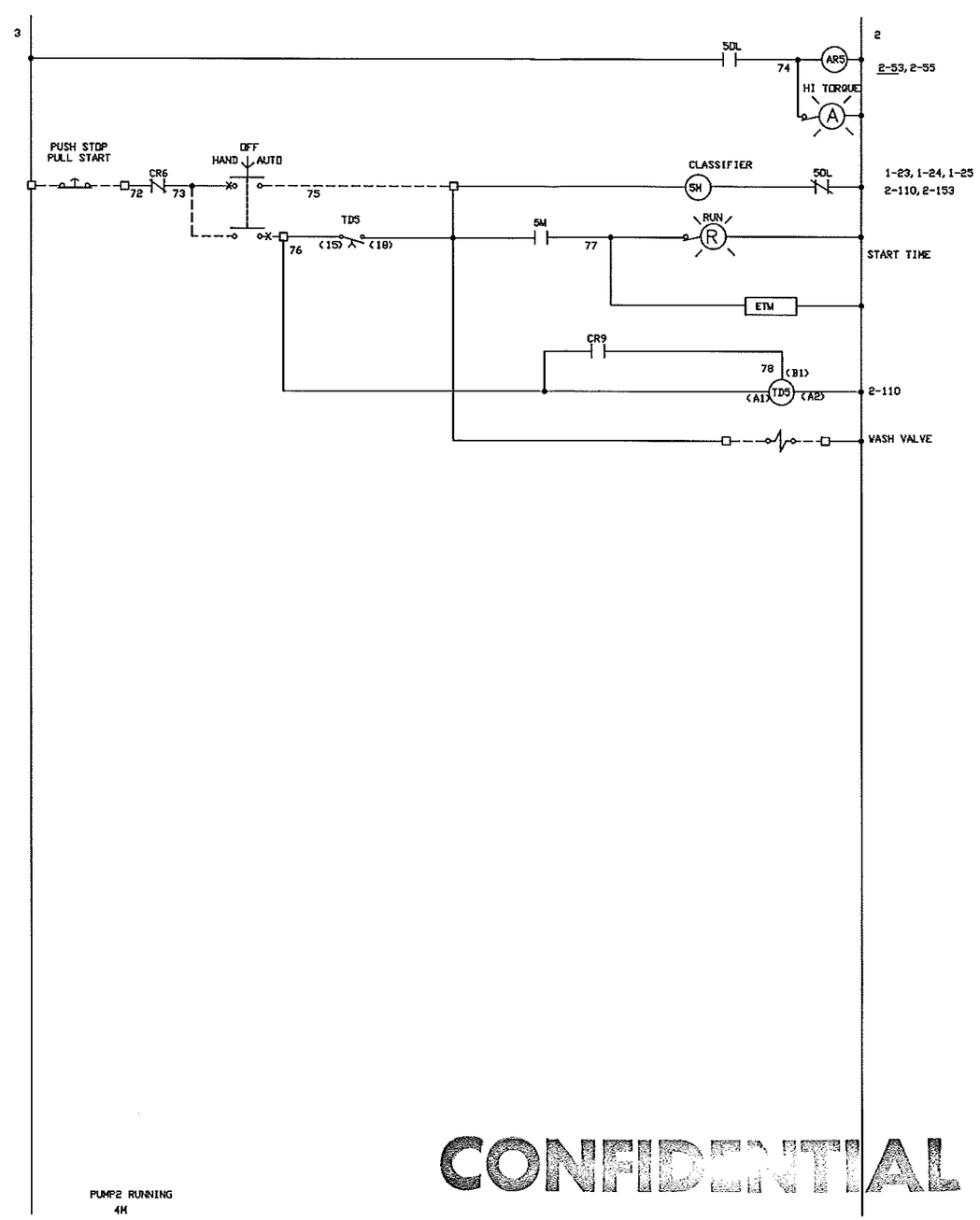
GRIT COLLECTOR 1 RUNNING — 1M 52 53
GRIT COLLECTOR 2 RUNNING — 2M 54 55
PUMP 1 RUNNING — 3M 56 57

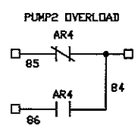
GRIT COLLECTOR 1 OVERLOAD — AR1 44 43 AR1 45
GRIT COLLECTOR 2 OVERLOAD — AR2 47 46 AR2 48
PUMP1 OVERLOAD — AR3 50 49 AR3 51

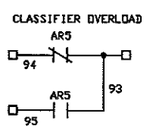
CONFIDENTIAL

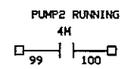
TITLE: GRIT SYSTEM FOUNTAIN, CO			
	B	4/3/12	AS BUILT
ELECTRICAL CONTROL SYSTEM SHT. 3 OF 4	A	1/28/12	REMOVE CLASSIFIER ZERO SPEED
FILE: 1757A4	REV	DATE	DESCRIPTION OF REVISION
DRAWN JT / CHECKED / APPROVED	REFERENCE		
DATE 7/15/11 SCALE NTS	SCHLOSS ENGINEERED EQUIPMENT, INC. AURORA, COLORADO		1757-11-A4

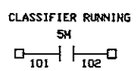












CONFIDENTIAL

LAST WIRE NO. USED 102

TITLE: GRIT SYSTEM			
FOUNTAIN, CO			
	0	4/3/12	AS BUILT
ELECTRICAL CONTROL SYSTEM SHT. 4 OF 4	A	1/26/12	REMOVE CLASSIFIER ZERO SPEED
FILE: 1757A5	REV.	DATE	DESCRIPTION OF REVISION
DRAWN: JT / CHECKED / APPROVED	REFERENCE		
DATE: 8/3/11	SCHLOSS ENGINEERED EQUIPMENT, INC. AURORA, COLORADO		1757-11-A5
SCALE: NTS			