	Standard Operating Procedure **Procedure Number:** **SOP–XXX-XXXX–XXX**	**Location Name:**
Prepared by:	**This is a portion of a procedure, for Sample evaluation purposes only.**	**Date First Issued:**
Reviewed by:	**Pump Motor Operation, Maintenance & Inspection**	**Latest Revision Date:**
Approved by:		**Revision #:**

Prerequisites & Information for Operation	
Purpose/Description	To perform operation, maintenance & inspection of a Siemens Induction motor on a RedaHPS (horizontal pumping system) [pump].

Prerequisites: What should be done before using procedure?	• Check the site, know your surroundings. Park at least 35 feet away and check for leaks with LEL monitor before driving into the area.
	  ○ Ensure the calibration of your LEL monitor is current (every 30 days), and is bump tested prior to use daily.
	• Must perform a Safe Work permit on all non-routine tasks, and on routine tasks IF a general Safe Work permit is not written for all daily duties.
	• Ensure that all of the following paperwork is on hand if needed, and is completed at the end of each procedure where required:
	  · Tailgate safety meeting form
	  · Safe work permit/hot work permit
	  · LOTO form
	  · Opening permit
	  · Non-permit confined space form
	• This procedure can be initiated by anyone who is qualified to run or operate the process in this procedure.
	• Make proper notifications before beginning procedure.

Core Information Needed	Siemens motor on a RedaHPS (horizontal pumping system) [pump].
Reference Documents	Siemens Instruction IOM Manual,
Permits Required	Safe Work Permit, Lockout / Tagout (LOTO)
Safety/Hazards to Operators or Environmental Concerns	Slips/Trips/Falls, Ignition Sources/Fire/Explosion, Pinch/Crush Points, Sharp Objects, Body Positioning, Weather/Lightning, Potential Spills/Leaks, Venting Hazards NOTE: Other Cautions, Warnings & Notes are embedded in the steps of the procedure. Read all of them before completing this procedure.
Equipment, Tools, Supplies & PPE Needed	PPE Level 1: Hearing protection, safety footwear, hard hat, eye protection, FR clothing, leather gloves, personal monitor Other Equipment & Supplies: crescent wrenches, torque wrench, ratchet and socket head set, appropriate lubricants,
Appendix/Attachments (as needed)	Appendix B: “Motor Control Set Points,” Appendix C: “Torqueing Specs,” Appendix D: “Lubrication Maintenance Summary”

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Procedure

1.0 Operating Pump Motor

CAUTION:	Repeated trial starts can overheat the motor and may result in motor burnout (particularly for across the line starting).

1.1 **IF** repeated trial starts are made, **ALLOW** sufficient time between trials to permit heat to dissipate from windings and rotor, to prevent overheating.

1.2 **After installation is completed, but before motor is put in regular service**, **MAKE** an initial start by following manufacturer's recommended commissioning checks.

1.3 **CHECK** motor starting and control device connections against wiring diagrams.

1.4 **CHECK** voltage, phase, and frequency of line circuit (power supply) against motor nameplate.

1.5 **CHECK** motor service record and tags accompanying motor.

1.6 **ENSURE** bearings have been properly lubricated and oil wells are filled. (See motor outline drawing

> **NOTE:** Step 1.7 below may have been done during installation procedure; if so, and conditions have not changed since, this check may not be necessary.

to determine proper oil level).

1.7 **IF** possible, **REMOVE** external load (disconnect drive) **and TURN** shaft by hand to ensure free rotation.

1.8 **IF** drive is disconnected, **COMPLETE** steps 1.9 through 1.9.3 below **and then SKIP** to 1.11 **and CONTINUE**. If drive is NOT disconnected, **SKIP** to step 1.10, **and CONTINUE.**

1.9 **IF** drive is disconnected, **RUN** motor at no load long enough to be certain that no unusual conditions develop.
1.9.1 **LISTEN and FEEL** for excessive noise, vibration, clicking, or pounding.
1.9.2 **IF** excessive noise, vibration, clicking or pounding are present, **STOP** motor immediately.
1.9.3 **INVESTIGATE** the cause and correct before putting motor in service.

1.10 **IF** drive is NOT disconnected, **INTERRUPT** the starting cycle after motor has accelerated to low speed.
1.10.1 **OBSERVE** CAREFULLY for unusual conditions as motor coasts to a stop.

1.11 **REFER** to motor's Starting Duty nameplate (if so equipped) or Motor Data Sheet for recommended number of starts and cooling period between starts.

1.12 When checks are satisfactory, **OPERATE** motor at minimum load **and LOOK** for unusual condition.

1.13 **INCREASE** load slowly to maximum.

1.14 **CHECK** unit for satisfactory operation.

> **CAUTION:** Guard against overloading. Overloading causes overheating and overheating means shortened insulation life. A motor subjected to a 10°C temperature rise above the maximum limit for the insulation may cause the insulation life to be reduced by 50%. To avoid overloading, be sure motor current does not exceed nameplate current when nameplate voltage is applied.

NOTE: Motors will operate successfully under the following conditions of voltage and frequency variation, but not necessarily in accordance with the standards established for operation under rated conditions:

a. When the variation in voltage does not exceed 10% above or below normal, with all phases balanced.

b. When the variation in frequency does not exceed 5% above or below normal.

c. When the sum of the voltage and frequency does not exceed 10% above or below normal (provided the frequency variation does not exceed 5%).

NOTE: Electric motors operating under normal conditions become quite warm. Although some places may feel hot to the touch, the unit may be operational within limits. Use a thermocouple to measure winding temperature when there is any concern.

NOTE: The total temperature, not the temperature rise, is the measure of safe operation. Investigate the operating conditions if the total temperature measured by a thermocouple placed on the winding exceeds:

230°F (110°C) for class “B” insulation
275°F (135°C) for class “F” insulation
302°F (150°C) for class “H” insulation

2.0 Voltage Regulation

WARNING: Dangerous voltages are present in the equipment which can cause severe personal injury and product failure. Always de-energize and ground the equipment before maintenance.

WARNING: Maintenance should be performed only by qualified personnel. The use of unauthorized parts in the repair of the equipment, tampering by unqualified personnel, or removal or alteration of guards or conduit covers will result in dangerous conditions which can cause severe personal injury or equipment damage.

WARNING: Explosion or Fire. Do not modify explosion-proof or dust ignition-proof motors. These motors are constructed to comply with the U.L. Label Service Procedure Manual. When reassembling a motor that has a U.L. Label, it is imperative that:

1. The original fits and tolerances be maintained.
2. All plugs and hardware be securely fastened.
3. Any part replacements are accurate duplicates of the original.
4. Reassembled motor must be inspected under U.L. Follow-up Service Program; repaired motor is to be relabeled by U.L. listed service shop.

To violate any of the above will invalidate the significance of this label, as the motor may no longer meet safety requirements for use in hazardous locations.

3.0 Maintenance – General PM

NOTE: Failure to properly maintain the equipment can result in severe personal injury and product failure. The instructions should be carefully reviewed, understood and followed.

The following maintenance procedures should be performed regularly:

1. Bearing lubrication
2. Insulation resistance check
3. Cleaning

The checklist in the Appendix of this SOP does not represent an exhaustive survey of maintenance steps necessary to ensure safe operation of the equipment. Particular applications may require further procedures. Should further information be desired or should particular problems arise which are not covered sufficiently, contact Siemens.

3.1 **VERIFY** motor is clean **and VERIFY** that stator and rotor ventilation passages are unobstructed.

3.2 **CHECK** for excessive loading or service factor.

3.3 **VERIFY** winding temperature rise not in excess of rated value.

3.4 **VERIFY** that the total temperature does not exceed the limits in tables below.

NOTE: Electrical apparatus operating under normal conditions becomes quite warm. Although some places may feel hot to the touch, the unit may be within limits. If checking total temperature by winding resistance or imbedded detector (RTD), the total temperature should not exceed the following.

When operating at full load:

		Class of Insulation System		
		B	F	H
Temp. by Resistance	All HP	120°C (248°F)	145°C (293°F)	165°C (329°F)
Temp. by Embedded Detector	1500HP or less	130°C (266°F)	155°C (311°F)	180°C (356°F)
	Over 1500HP -Under 7000V	125°C (257°F)	150°C (302°F)	175°C (347°F)
	Over 1500HP -Over 7000 V	120°C (248°F)	145°C (293°F)	165°C (329°F)

When operating at 1.15 service factor load:

		Class of Insulation System		
		B	F	H
Temp. by Resistance	All HP	130°C (266°F)	155°C (311°F)	175°C (347°F)
Temp. by Embedded Detector	1500HP or less	140°C (284°F)	165°C (329°F)	190°C (373°F)
	Over 1500HP -Under 7000V	135°C (275°F)	160°C (320°F)	185°C (365°F)
	Over 1500HP -Over 7000 V	130°C (266°F)	155°C (311°F)	175°C (347°F)

These temperatures represent the maximum temperature for each class of insulation and include a 40°C ambient temperature. Operation above these temperatures will result in reduced insulation life.

3.5 **VERIFY** insulation resistance is above recommended minimum.

3.6 **VERIFY** voltage and frequency variation.

3.7 **CHECK** air gap.

3.8 **VERIFY** that bearing temperatures are within limits.

3.9 **VERIFY** that lubricant is clean and proper level maintained.

3.10 **VERIFY** no unusual vibration or noise exists. **IF** no unusual vibration or noise exists, **SKIP** to Step 3.11. **IF** unusual noise or vibration exists, **CONTINUE** with Step 3.10.1 below.

3.10.1 **CHECK** for:

- Loose or missing parts such as fan blades, nuts, bolts, screws, couplings, etc.
- Accumulation of dirt on fan or rotor
- Associated equipment – **DISCONNECT** equipment to determine where the vibration is being generated
- Foundation construction – Base, grouting and associated equipment supporting drives must be in good condition. Vibration can be amplified by weak construction. Vibration of base just below motor feet should not exceed 25% of motor vibration
- History – When was vibration first noted? Was there a change in loading and / or duty of equipment? Has ambient vibration changed?

NOTE:	More important than the actual vibration is the vibration change over a period of time.

3.11 **CHECK** alignment.

3.12 **CHECK** for proper lubrication.