Manual Section 7	Issue Date 11/14/07	Revision Date 01/01/24	Policy Number LLCP-055

Air Compressor Operations

Purpose
Significant differences exist in compressors and their use. These two differences are LIFE SUPPORT and NON-LIFE SUPPORT operations. This policy is intended to increase awareness about life support and non-life support systems. Furthermore, life support compressors should not be used for industrial air operations. The pressure and flow rates are different and the systems are not interchangeable.

Scope
All LLC Companies including, Blanchard Industrial, LLC, GIS Engineering, LLC, Grand Isle Shipyard, Inc., and GWIS, Mack Steel, NuWave, Sun Industries, Valvemax, Discovery Industries, Inc.; hereafter identified as "Company".

General
LIFE SUPPORT compressors use only Monolec Oil. This oil is used for lubrication of piston-type compressors in life support operations. Monolec oil is particularly suited for compressors producing breathing air. It is berry red in color and easily distinguishable from most other oils. However, Monolec Oil closely resembles Dexron II Oil, the petroleum-based compressor oil used in the rotary screw designs.

Persons responsible for maintaining this equipment must know the difference between these oil types and should be thoroughly familiar with this safety information.

Handling Compressor Skids
Weight of the compressor should be identified before the lifting a compressor.

Proper lifting techniques and Tag-lines should be utilized to control a skid whenever it is hoisted.

No materials or items should be stored on top of a compressor skid. Gear such as hoses, lift bags, tarps and other similar items, when draped across the frame, can damage the spark arrestor, exhaust pipe and/or air intake assembly. Similarly, equipment should be stored in the skid, to prevent them from becoming fouled in the drive belts or other rotating parts.

Setting a Compressor Skid in Position for Use
When stowing a skid, topside personnel should take special care to locate the compressor intake away from sources of contamination. These sources include: diesel exhaust fumes from any fuel tank vent, smoke from welding or cutting operations, paint fumes, grit from abrasive blasting, and other similar air-borne contaminants which pose a problem to the diver or the compressor.

Because of the noise of the diesel engine, the skid should not be set up near a dive station. Persons working around the unit when it is in operation should wear hearing protection and safety glasses.

Whenever possible, topside personnel should place dunnage or wooden planking beneath the compressor skid to dampen vibration and reduce noise.

As a general rule, life support equipment is not required to have a remote shutdown. Diesel engines, which drive compressors, should not have a line rigged to their air intake to shut down the engine. It is possible that some diesels have pins installed in their intake assemblies. These pins should be left in place and not tampered with.

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Before starting the diesel engine, topside personnel should inspect and service the various components of the skid.

Compressor Checks

- Examine the nuts and bolts that hold the compressor on its foundation on the skid. Use a properly sized box-end wrench or an adjustable-end wrench to tighten the nuts.
- Examine the drive belts to detect cracks or worn areas. Note the tension on them and note the alignment on the drive wheels.
- Remove and examine the compressor oil pump dipstick. The level should be at or near the upper (full) mark.
- If it is necessary to add oil, use Monolec Oil for all life support system compressors.

Diesel Engine Checks

- Examine the nuts and bolts that hold the engine on its foundation on the skid. Use a properly sized box-end wrench or an adjustable-end wrench to tighten the nuts.
- Remove and examine the engine oil pan dipstick. The level should be at or near the upper (full) mark.
- Add oil if necessary.
- Never add engine oil to the compressor.
- Examine the engine for signs of oil leaks etc. Look at the gasket joints for seepage, and look in the drip pan. Trace the tubing; flex hose and fittings of the oil pressure gauge line between the block and the gauge.
- Topside personnel should not allow water or oil to accumulate in the drip pan (the levels can rise to immerse to the lower edges of the compressor drive wheels and the drive belt, thus causing slippage).
- Drain and wipe up all water and oily waste from the drip pan beneath the engine into the bucket or similar container. Deposit the oily waste mixture into the drum designated for waste oil.
- Do not drain the skids drip pan onto the deck.
- Make sure all drip pans are plugged.
- Do not open the radiator cap if the engine has been running and has not cooled down.
- Use only fresh water for replenishing the radiator.
- Check the engine fuel filter, fuel tank, and fuel lines for signs of leakage.
- Don’t let water build up in the fuel filter.
- If it is necessary to change the fuel filter, make certain that a canister is not cross-threaded.

Air Start

There are two methods commonly used to start a compressor, diesel with air; direct supply of stored air from the volume tank or a secondary source, such as a rig service or ship’s service air.

Two things are important for air start. The pressure should be at least 125 psi and the volume sufficient to crank the engine for 3 to 4 seconds (this will quickly deplete the volume tank).

Attempting to start the engine with less than 125 psi or with too little volume can result in the starter motor’s bendix being partially extended onto the flywheel but unable to turn it at a sufficient speed to start.

If using air supply from a non-life support system, there is a reason for concern for contamination if the hose is connected to the volume tank. Therefore, to prevent contamination, the volume tank should be bypassed and the air hose should be connected to the crow's foot connection on the starter motor.

A valve should be in the air supplying line at the starter motor. The valve is necessary to limit and control the flow at the starter. (If using a long length of hose without a valve, what can occur is the pressure of the air supply is sufficient to extend the bendix and turn the engine, but the constant flow will keep it extended and not to allow the pinion to retract and the engine to start.)

Before connecting the air supply to the starter motor, examine the drive belt between the engine and the compressor. Remove any tools or objects on or near the drive belts or the wheels.

Let the air flow to blow out any debris that may be in the hose. Caution: wear appropriate eye protection and warn other personnel in the area before you blow out the air. Gripping the hose near hose fitting, hold tightly with both hands and point the open end of the hose over the side, away from other persons in the area.

Examine the crow's foot connection to ensure it has a gasket and use a safety pin clip to hold the two connections together.

Maintenance

The Company recognizes that there are several critical elements that contribute to safe and effective operations of air compressor units. The Company operates several brands and categories of air compressor units and in order to properly maintain and safely operate these units employees should:

- Read and understand all manufacture guidelines for safe operation.
- Read and understand all manufacture guidelines for maintenance.
- Ensure each unit is sent in for maintenance by a Company approved technician in accordance with manufacture recommendations i.e. annually, monthly, hours of operation, etc.
- Preform a pre-start checklist prior to unit operation.

Furthermore, the Company recognizes that the following elements also contribute to safe and effective operations and therefore should be general rules of guidance when operating an air compressor:

- **Clean, Cool Inlet Air:** Cooler air means less work is required to produce line pressure. Ideally, the air intake should be located in a clean, dry, shaded area outside the building, at least six feet from the ground. Intake ducts should deliver minimum pressure drop at full capacity.
- **Correct Air Filter Capacity and Condition:** Take readings from the instrumentation installed in the suction line between the filter and compressor at each shift to check for leakage (insufficient vacuum) or excessive restriction (too much vacuum). Using the correct filter can produce a dollar benefit through longer filter change intervals and/or reduced load time.
- **Optimum Compressor Operating Temperature:** Abnormally high operating temperatures can result in a fire or explosion, so take steps to maintain proper temperatures as recommended by the compressor manufacturer.

  As a rule of thumb for reciprocating compressors, maintain the water temperature at 10ºF above the inlet air temperature to prevent moisture from condensing in the cylinders of water-cooled compressors.

Cooling water outlet temperatures should not exceed 120ºF. To ensure proper operating temperatures, never start a compressor with water flow and cease flow when the compressor is shut down.

Control proper temperature by periodically inspecting and cleaning water jackets. Measuring temperature difference between inlet and outlet water pipes helps determine when the water jacket requires cleaning. If air cooled, routinely check that the fins are not clogged with dirt.

- **Proper Lubricant and Feed Rate:** To allow compressors to perform correctly, select lubricants with characteristics suited to your service conditions. Best practice considerations include ensuring cleanliness in storing and dispensing these lubes and the application of correct quantities.

    - **Reciprocating** — Cylinder oil lubrication is an important factor. Maintaining the correct feed rate protects metal surfaces and helps prevents sludge and deposit build-up. If over- or under-fed, you can run the risk of high wear rates on cylinders and rings, as well as over-heating and high oil consumption.

    - **Centrifugal** — Centrifugal lubrication helps protect the bearings (and step-up gears in some models). Therefore, using the correct oil helps minimize wear, resist oxidation and perform in the presence of water.

    - **Rotary Screw** — Some are flooded by lubricant, others operate with dry screws. When wet, properly cooled oil is required to help absorb the heat of compression and also lubricate the rotors and provide sealing. Oil-to-air or water-to-air heat exchangers help ensure a cool oil supply and minimize carbon deposits on compressor components. Dry-screw compressors simply require proper lubrication of the bearings.

- **Efficient Air Cooling Systems:** Between stages of air-cooled compressors, air is directed by a fan. Clogged dirt restricts proper cooling. Adequate means for separating, trapping and draining water condensed from the air are essential. Check to ensure that proper water draining is taking place.

- **Safe Storage of Reserve Air Capacity:** An air receiver is an essential part of most plant air systems. Arrange receivers to completely drain entrained oil or water condensed from air or carried over from after-coolers. Also, a spring-loaded safety valve, installed at the receiver and tested regularly, helps ensure safe operations.

- **Delivery of Dry Air to Point of Use at Required Pressure:** Up to five percent of plant maintenance costs can be spent combating the damaging effects of unwanted moisture in compressed air systems. Frequently, air discharged from compressors is cooled in after-coolers in order to remove water and thus prevent or minimize the condensation of moisture in the air distribution system. Dryers may also be required. Routine inspection and maintenance helps ensure dry air and delivery at the intended pressure. Loss of pressure between the compressor and the point of use is unrecoverable and, therefore, money out of your pocket. A good rule of thumb to remember is that air pressure below 90 psi is too low for air devices to operate at 100 percent efficiency.

- **Air Line Lubricators:** Airline lubricators provide lubrication to devices run by compressed air. Typically, a lightweight oil, easily carried by the air, helps operational efficiency. Keep the oilers full and replace oil that appears to be milky or dirty.

- **Minimized Air Leaks:** Air leaks anywhere in the air system cause the compressor to compress more air than it needs to thus increasing your operating costs. Air leaks can be easily located with ultrasonic leak detectors.