**[Your Logo Here] In Cooperation With**

 **FIELD GAS COMPRESSOR**

 **SAFETY, INSTALLATION AND OPERATIONS GUIDELINES**

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[Your Company Name Here] makes no representations, warranty, or guarantee in connection with publication of these guidelines and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use or

for any violation of federal, provincial or local regulations with which it may conflict.

The purpose of this guide is to help you achieve the best results from your gas compressor unit by providing safety, installation, and operation guidelines. These guidelines are furnished to establish a minimum level of understanding, and are not intended to replace or supersede the end user's own company policies and insurance guidelines, manufacturer's guidelines, construction or piping codes, safety regulations, federal, provincial, or local regulations

or most of all, common sense. Ultimate responsibility remains with the end user.

Please make yourself and your operating personnel aware of the following information and impress upon them

the possible dangers around which they work. It is our hope that with consideration, these facts might prevent unnecessary harm to personnel and machinery.

This compressor has been designed and built to the highest safety standards possible. However, it must be remembered that the safest machine is only as safe as the operator running it. With this in mind, please consider the following points:

1. A compressor operator must always keep in mind that his machinery is handling a highly flammable substance - natural gas - and as long as the natural gas is not allowed to mix with air, it is relatively incombustible.

However, if air is allowed into the system, an explosion could be possible.

Any gas (air or natural gas) flows to any lower pressure area. Therefore, any time the pressure in the gas system (i.e., compressor cylinders, main piping, bypass/vent piping, scrubbers and bottles) is lower than atmospheric pressure, the compressor is pulling a vacuum and air will try to enter. Be sure all possible points

of entry are closed.

2. The system must be fully purged of all air before start-up and a positive pressure maintained on the complete system at all times while starting, idling and running.

A combustible situation may occur if a gas line breaks, generally due to machinery vibration,

allowing pressurized gas to escape.

If there is excessive vibration in the gas compressor package, do not dismiss it as normal operations.

Assess the severity of the problem and repair it if necessary or contact your Service Representative.

Do not allow continued operation until the cause of the vibration has been repaired.

3. Always consider your possible path of escape if a fire or explosion were to take place. Keep the area around

your compressor free from machinery, debris, production equipment, and other sources of combustible

material, so personnel can escape quickly.

**SAFE AND EFFICIENT OPERATION IS THE RESPONSIBILITY OF THE END USER**

**SAFETY PRECAUTIONS**

1. **Never adjust or repair a machine while in operation.**

Always stop the engine before cleaning, servicing, or repairing. Place all controls in the OFF position, and use locking devices and Do Not Operate tags to prevent accidental restarting when needed. Before restarting, make sure that all tools and other material are removed from the engine and equipment.

1. **Keep the compressor package area clean.**
2. **Do not wear loose clothing around machinery.**

When around machinery, loose clothing, neckties, rings, wrist watches, bracelets, hand rags, etc., should not be worn.

1. **Replace damaged fan blades promptly.** If a fan blade or fan drive shaft is bent or damaged in any way, it should be replaced. Do not attempt to repair or use the damaged parts. Fan assemblies must remain in proper balance.

When damaged, an unbalanced fan can fly apart during use and create an extremely dangerous condition.

1. **Be sure engine operating area is properly ventilated.** The exhaust products of an internal combustion engine area are toxic and may cause injury or death if inhaled. All engine installations within a closed shelter or building, must be equipped and maintained with an exhaust discharge pipe so that exhaust gases are delivered to the outside air. A closed building or shelter must be adequately vented. A means of providing fresh air into a closed building or shelter is necessary.
2. **Observe no smoking rule.** Do not smoke (or have any open flame) around pressurized gas compressor equipment at any time.
3. **Avoid ignition voltage shock.**

Avoid contacting coils, magnetos and battery ignition systems, as they can cause an electrical shock. Only qualified service
 technicians may perform work inside control panels and instrumentation boxes.

1. **Always allow compressor package to cool before servicing.** Wait until engine and coolant have cooled down before removing radiator or surge tank caps. Inspect and replace weak or damaged hoses, lines, and fittings as soon as possible.
2. **Provide adequate fire protection.** Fire extinguishers must be easily accessible in the event of an incipient stage fire. Select alternate routes of escape from any compressor package installation and post such routes in accordance with local and government requirements.
3. **All safety guards must be kept in place during compressor operation.**
4. **Safety equipment.** Safety equipment such as hearing protection, safety glasses, hard hats, safety shoes or boots and fire extinguishers are recommended, and are required by some local, state or federal regulations, and by some insurance carriers.
5. **Visually inspect unit before starting.** Prior to starting, operators must walk around the compressor package and visually inspect the unit for loose or broken components, tools, open valves, missing equipment, etc.
6. **Do not modify the compressor package systems.** There are to be no modifications to the compressor package without the written consent of the leasing company. Improper modifications can invalidate vessel and piping codes and can pose potential hazards to personnel and equipment.
7. **Do not tamper with, modify or bypass package safety and shutdown equipment.** This compressor package has been equipped with safety equipment which will protect both equipment and personnel. No modifications to or bypassing of the compressor shutdown or safety systems may be made without the written consent of the leasing company.
8. **Do not exceed maximum allowable pressures and temperatures.** Be sure all maximum allowable pressures and temperatures are not exceeded when starting, running, stopping or bypassing the compressor package. Serious equipment damage and personnel injury could result should maximum allowable pressures and temperatures be exceeded.
9. **Specialty gases**. This compressor package is designed to be operated with and compress **sweet** natural gas containing

**no** hydrogen sulfide (H2S), minimal amounts of nitrogen (N2) and carbon dioxide (C02) and no air. Consult your compressor leasing company for additional guidelines should the compressed gas stream contain any H2S, or an unusually large amount

of N2, C02 or air.

Safety starts with attitude. There are standard safety rules but every situation has its own hazards which cannot

always be covered by rules. Therefore, your training, experience and attitude about working safely will be your best guides. Lack of attention to safety can result in: accidents, personal injury, reduction in efficiency and worst of all - loss of life. Watch for safety hazards. Correct deficiencies promptly.

[2]

### INSTALLATION INSTRUCTIONS

Before installing this equipment please carefully read the following:

## I. SITE

A. The Compressor(s) should be as near to the well as practical, but no closer than common practice dictates.

B. BASE REQUIRED:

1. STEEL SKID - Consult our Service Representative or Engineering Departments for assistance in

designing a concrete slab.

1. Concrete--Filled Skid

BARE GROUND-Locate compressor on a solid, level, smooth surface with adequate drainage.

Uniform contact with the underside of the skid is very important to prevent high centering and vibration.

Some form of fill material may be required to ensure the uniform contact with the underside of the skid results.

Fill materials such as dirt, crushed rock or gravel can be used. If in doubt contact our service

representative or engineering departments for recommendations.

EXISTING CONCRETE SLAB - Smooth the slab as much as possible, cutting off protruding anchor bolts and removing old grout and concrete protrusions. Cover an area the size of the skid on the slab with expansion joint material, with one of the commonly available builder's products, or with sand.

If sand is used, make provisions to keep the sand from washing out from under the skid.

Provide sufficient material thickness to ensure that uniform contact with the underside of the skid results

and that the compressor will not teeter on any of the high spots of the slab.

C.

1. Clearance-Provide at least ten (10) feet of clear work space around the unit on all four sides.

Keep in mind that compressors need to be serviced and that we will need to get a service truck with

a hoist next to the unit. When enclosing a unit with plywood, insulation board, etc. allow 10' clearance around unit and provide two (2) exits to prevent personnel from being trapped in the enclosure.

1. Unit Orientation--The engine radiator must face the summer prevailing breeze, usually south.
2. Unit Position--Compressor must be a safe distance from any ignition source, such as heater treaters, dehydrators, or line heaters.
3. Unit Elevation--Place unit to provide highest possible elevation to allow adequate drainage in bad weather.
4. If your location is to be fenced, leave a gap or gate large enough for our service trucks to get to the machine.
5. Compressor should be a safe distance from all production equipment including well head, separators, stock tanks, etc.

II. **SUCTION PIPING**

1. A field separator must be installed between the well and the compressor to remove free liquids from the gas stream.
2. A full opening block valve should be placed in the line downstream of the separator as close to the unit as possible.
3. A suction pressure control regulator must be installed between the block valve and the compressor when

the well pressure is higher than the rated suction pressure of the compressor.

1. The suction line must be connected to the inlet scrubber of the compressor.
2. All suction piping must be purged of all objects prior to final piping connection.

III. **DISCHARGE PIPING**

1. From the aftercooler discharge, a piston type check valve is required, located as close as possible to the compressor.
2. Downstream of the check valve, place a full opening block valve in the line.
3. The discharge line is run to the dehydrator (if required), then to metering and finally to the pipeline sales point.

Notes:

* All piping and components should be of working pressures equal to or greater than the highest possible pipeline pressure. For example, rubber or flex hoses, or PVC are prohibited. Threaded suction and discharge piping connections are discouraged as breakage may occur due to vibration and/or stress
* as the skid or foundation settles.
* Piping should be sized to ensure adequate suction pressure and volume into the compressor and provide minimal pressure drop through the discharge line into the pipeline.
* Piping should be buried, supported or adequately secured to prevent vibration.

Make an as-built print or sketch of any buried line locations.

* Metering equipment should be a safe distance from the compressor to minimize pulsation and
* vibration problems.

[3]

IV. **VENT LINES**

Most compressors have vent lines, relief valve vent lines, air/gas starter vent lines and blow down vents. To prevent fires and explosions, these vent lines must be piped a safe distance from the compressor unit and any type of ignition source. The starter

vent should be piped separately with adequately sized lines to ensure proper operation of the air/gas starter. Vent lines and

drain lines must not be connected into a common header.

V. **LUBE OIL SUPPLY**

An overhead lube oil supply tank is required with most compressor units. These tanks should be piped with 3/4" rigid pipe

and set far enough away from the unit so that it will not interfere with servicing the unit. Our Service Manager will be able

to recommend an oil distributor in your area to furnish an overhead tank as well as the type of oil to use. Local, State or Federal environmental regulations may apply to the lube oil supply.

VI. **ANTIFREEZE SUPPLY**

If your compressor arrives without coolant, the initial fill should be made with water which allows any leaks to be repaired

without waste of expensive coolants. As soon as possible after start-up, the water should be drained and replaced with a

commonly available premixed antifreeze solution. Specific recommendations can be furnished upon request from our service department including local distributors in your area.

1. **DRAIN LINES** - Most compressors have lube oil, jacket water, packing/distance piece and compressed liquid drains.

To prevent fires and explosions, these drain lines should be piped a safe distance away from the compressor into

a tank or drum.

1. WASTE OIL--Waste oil needs to be stored and disposed of in a safe non-polluting manner. Please furnish

empty oil drums so our service representatives have a proper way of disposing of waste oil from oil changes.

1. WASTE GLYCOL/WATER Since antifreeze may contain trace amounts of heavy metals and needs to be

stored and disposed of in a safe and non-polluting manner, please furnish empty drums for our service representatives to use.

1. COMPRESSED LIQUIDS--Since some liquids formed through the process of gas compression are volatile, it is recommended that these drains be piped away from potential sources of ignition. The disposal, handling and transportation of these liquids are left to the end user’s discretion.

VIII. **FUEL AND STARTING GAS SUPPLY**

Most of the time, fuel and starting gas are piped from the suction or interstage scrubbers on the unit and no outside piping

is necessary. However, we recommend a sweet and dry gas source of adequate pressure and volume if possible.

Our Service Representative will be happy to assist you in designing a safe, proper supply system.

[4]

### OPERATING INSTRUCTIONS

## I. STARTUP PREPARATION

1. DO NOT attempt the initial start of the unit without the service representative's approval.
2. A service representative will be provided for the initial start-up of the compressor unit. Please notify us at least a day ahead of when you are sure the hook up will be completed.

## II. STARTING UNIT

1. When unit has been shut down, check for reason.
2. If possible, make the necessary corrections to the unit and reset the safety panel to allow for start-up.
3. Purge unit before restarting or if gas system has been opened up to the atmosphere.
4. Close suction block valve.
5. Close discharge block valve.
6. Open the bypass valve.
7. Open the blow down valve.
8. Open the suction valve allowing gas to blow out of the blow down line.
9. Close the bypass valve, making sure at this point gas is still blowing out the blow down line.
10. Open discharge block valve.
11. Close the blow down valve, at this point the system should be purged.
12. Open bypass valve and you are now ready to start unit.
13. Set timer in control panel.
14. Set the engine throttle to starting position.
15. Set all low pressure shutdown points to just above the lowest pressure indicator. Make sure the final discharge high pressure switch is set to within operating limits in case the discharge line is blocked downstream.
16. Reset the fuel gas vent valve if equipped.
17. Start the unit and check for any unusual noises or vibrations and if any are present, immediately shut the unit down. Locate the source and correct if possible. If the source cannot be corrected, contact the appropriate service personnel.
18. After starting, move the timer to zero.
19. Allow the unit to run and warm-up with the bypass valve open. Check the engine and compressor oil pressure gauges to be sure they are in the proper range. Check the lubricator for proper operation and all oil and coolant levels.
20. Open throttle on the engine.
21. To load the compressor, slowly close the bypass valve.
22. Check pressures, temperatures and levels again and reposition any shutdown switches changed in step "O" above to the proper position. All shutdown switches should be set to insure that the compressor will be shut down should the operating conditions exceed the recommended limits. Consult your service representative to show you where these points are. Remember the safety shut-down system is provided to protect both personnel and equipment and should not be bypassed in any circumstances.

Please note that the above starting procedures may not be applicable to some brands of compressor equipment in some instances. Consult your service representative should the starting procedures be different from those listed.

Ill. **WHAT IS EXPECTED FROM THE OPERATOR.** Daily maintenance of the unit to include:

1. Daily maintenance including maintaining proper levels of oil and coolants.
2. Routine checks of compressor operations, including temperatures and pressures, in written operating reports.
3. Promptly reporting any problems to the appropriate service representative.
4. Reasonable access to location.
5. A key or lock combination to any locked gate must be furnished to our service personnel

[5]