



INSTALLATION OPERATION & MAINTENANCE MANUAL

NATURAL GAS COMPRESSOR



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IMW COMPRESSOR MANUAL MAIN DOCUMENT LIST

The IMW compressor manual consists of a list of general instructions applicable to IMW compressor systems and appendices containing customer specific information. These appendices provide internal IMW documentation to the customer to help maintain the compressor.

As the Main Document List, this document lists the complete set of items that comprise the IMW customer installation, operation and maintenance manual: the general instruction manual, drawings, electrical schematics and other additional or customer specific data tables.

Description	Document Number	Revision	Pages
IMW Compressor Manual - Main Body	WI-AD-2008-004	0	51
IMW Compressor Manual - Service Document List	FO-AD-2009-004	0	1
IMW Compressor Manual - Installation Document List	FO-AD-2009-002	0	1
IMW Compressor Manual - Additional Document List	FO-AD-2009-001	0	1



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1. SYSTEM OVERVIEW

Each compressor is skid mounted and consists of a compressor, driver motor/gas engine, belt and sheave power transmission, inter-stage gas piping, cooling system, recovery tank and electrical controls. The electrical controls are remotely mounted or housed with the compressor or located in an attached electrical control room. The compressor skid may be mounted in a weatherproof and sound attenuated enclosure. The compressor enclosure may include a recovery tank, gas inter- and after-coolers, inlet and outlet silencers, and storage vessel compartment, entrance door, gauge panel viewing window and removable wall section or service doors for compressor skid removal and compressor services.

In many installations, the discharge gas from the compressor enters a priority/ESD panel. The panel may be skid mounted or located outside of the enclosure in a NEMA 4 or 3R weatherproof enclosure. The priority panel controls all compressor discharge gas for the filling of the pressure vessel storage cascade. The emergency shutdown (ESD) panel consists of valves that automatically isolate the storage cascade in the case of an emergency.

The dispensers are located remotely from the compressor and the storage cascade. The dispensers provide the dispensing point for the filling of vehicles equipped to operate on natural gas as a fuel.

The particulars of your system components and configuration can be determined from the materials lists, parts literature and equipment drawings and schematics found in applicable sections of this manual.

2. GENERAL SAFETY REMARKS

- Highly compressed gases contain a large amount of energy and are very dangerous! Carry out maintenance and repair work on entirely vented pressure systems only!
- Installation, operation, maintenance and repair work shall be carried out only by qualified personnel and in accordance with the corresponding local regulations for operation and safety.
- Rotating machine parts represent a special danger for accidents. Covers and guards must not be removed during operation!
- Do not store easily inflammable materials near the compressor unit!
- Smoking is strictly forbidden in the proximity of oil and fuel systems.
- Do not touch exposed wires and live (current-carrying) parts when the electrical system is energized!
- Never interrupt electrical protective conductors!
- Only qualified personnel shall open the electrical controls.

3. SAFETY INSTRUCTIONS

The following instructions are provided for the protection of the life and health of all operation and maintenance personnel. Included are some general instructions for good machinery maintenance and repair work practice. These safety instructions are based on the WorkSafe BC Occupational Health and Safety Regulation and may not apply outside British Columbia, Canada. For specific safety requirements, see local health and safety codes and standards.



CAUTION: DO NOT ALLOW UNAUTHORIZED PERSONNEL IN THE COMPRESSOR, STORAGE CASCADE OR DISPENSER AREA.

3.1. ENTERING HAZARDOUS AREAS

- No person shall enter the compressor room until it has been established as being a safe environment. WSBC - OHS Reg. 4.3
- When work is done in the compressor room or storage area, the atmosphere shall be monitored for O₂ deficiency and explosive limits, in accordance to WSBC – OHS Reg. 9.25.



- When working in the container, be sure the area is well ventilated, in accordance to WSBC – OHS Reg. 9.30.
- Footwear shall be in accordance with WSBC - OHS Reg. 8.22.
- When near any pressurized area the worker shall wear eye protection which is attached to their head, in accordance with WSBC - OHS Reg. 8.14.

3.2. LOCK OUT PROCEDURE

- The compressor motor and related electrical equipment shall be locked out in accordance with WSBC – OHS Reg. 10.4 when work is to be done on the compressor skid.
- If work is to be done on any electrical circuit, it must be de-energized, in accordance with WSBC - OHS Reg. 10.2. Watch for control systems that may have more than one source of power.
- The inlet line and discharge line must be locked-out so that no person can open them inadvertently. The use of a pad-lock and chain are an acceptable means. This procedure must be done when removing any lines or piping from the compressor.
- When work is to be done on the compressor block, preventative measures to ensure no rotation of machine parts are to be established.
- The electrical control panels may be opened only by qualified and authorized persons. Before opening electrical control panels, turn the ONLINE/OFFLINE switch to OFFLINE and lock out the main power supplies to the panel. Before opening explosion proof panels, the panel location area must be declassified by the following procedure (for area classifications refer to CGA/CAN B149.1 or equivalent code).
- Lock out gas supply to compressor and/or piping systems within the classified area. The equipment is designed for Class I, Division 1 or 2, Group D hazardous or unclassified locations. NOTE: Please reference the compressor or panel nameplate for the actual hazardous area classification as the divisions and classifications may change depending on specific design criteria.
- Purge all compressor and/or piping systems with nitrogen.
- After completing all work in the explosion-proof panel, replace all bolts and torque before allowing any gas to refill the compressor and/or piping systems.

3.3. REMARKS ON OPERATION

- The compressor has to be maintained in a safe condition to operate properly, and should be regularly inspected!
- Before setting the compressor unit into operation, be absolutely sure that no one is carrying out inspection or repair work on the compressor!
- The compressor may be operated only in accordance with the technical specifications!
- Take care that no one can get into contact with piping - especially exhaust piping - or other parts of the compressor unit that are hot during operation!
- When there are oil or fuel leaks, remove the run-out liquid, but also repair the leak!
- Never carry out any work when the compressor unit is operating!
- When a major gas leak develops in the compressor, isolate the machine by using key switch.
- When a major gas leak develops in the dispenser, isolate storage system from dispenser.
- Be aware that when observing compressor at rest, it may start automatically at any time.
- Never allow unauthorized personnel inside the compressor enclosure or inside gas storage area.
- Never allow unauthorized modifications to equipment. All modifications are to be made in accordance with an authorized design.



- At all times ensure a safe and clean working environment.

3.4. REMARKS ON MAINTENANCE AND REPAIR WORK

- Maintenance and repair work may be carried out only on the shut down and entirely vented compressor unit. The main switch on the control panel of the unit must be set to the "OFF" position. Switching on of the unit should be prevented by locking out main power or by providing a corresponding instruction label. Before starting work, open all manual drain valves on the condensate separators to ensure that the compressor unit is entirely without pressure!
- The relevant inspection authority must re-accept every modification or repair work on pressure vessels and safety equipment for which test certificates are required.
- Only use original spare parts and recommended products for maintenance and repair work on the compressor unit!
- Never do work that produces any heat such as welding near oil or fuel systems. Before working on oil or fuel tanks, empty them and clean them thoroughly (ex. by a steam jet!).
- During maintenance and repair work, observe strict cleanliness. Keep impurities away by covering un-assembled parts and free openings with a clean rag, papers or adhesive tape.
- After completing work be sure that no tools, loose parts, or cleaning rags have been left on or in the compressor unit!
- Do not use easily flammable solvents for the cleaning of parts. After the use of any solvent, thoroughly clean the part with compressed air.
- The manufacturer assumes no responsibility for physical harm or damage to the compressor system or any unauthorized persons caused by the non-observance of safety precautions or by the omission of the due diligence and caution generally associated with such work as is necessary for the handling, operation, maintenance and repair of CNG refuelling station equipment.

4. WARRANTY STATEMENT

Please see the warranty appendix for the warranty statement.

5. SPARE PARTS ORDERING INFORMATION

IMW recommends that only OEM parts be used in your IMW compressor to maintain the mechanical integrity and provide the longest services life as originally designed. OEM parts must be used to ensure that any and all applicable warranties can be honoured.

IMW has regional representatives and service centers in most markets where IMW equipment is sold. Parts should only be ordered through the authorized dealer in your area to ensure the best service and future parts availability. Please contact your local IMW service provider for all your parts requirements or IMW Head Office for further assistance.

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INSTALLATION AND PRESERVATION

6. INTRODUCTION

The following information is provided as a guide for equipment installation. Not all installation design details are provided. It is recommended that the services of an experienced installer be enlisted so that all relevant local codes and regulations are met with the design of the site installation. Please contact your sales representative for further information. Site electrical schematics and a compressor general arrangement may be found in the Installation appendix.

7. COMPRESSOR ENCLOSURE INSTALLATION

7.1. ENCLOSURE CONCRETE FOUNDATION

The compressor enclosure must be provided with a flat and level concrete foundation at least as large as the plan dimensions of the compressor enclosure, plus a 12" concrete margin around the entire enclosure. Concrete pad thickness and reinforcement must be determined according to the weight distribution of the enclosure and the underlying soil properties. All relevant local building codes should be met for this purpose. For the concrete pad design, the gross equipment weight can be considered to be evenly distributed over the plan area. If dynamic forces due to equipment rotation are required, please contact the factory. Poorly prepared foundations will lead to excessive vibration which will cause premature equipment failure and void the warranty.

Compressor enclosures may have removable electrical access plates to facilitate entry of electrical cable or conduit into the enclosure for electrical hook-up. If so, concrete pads must be constructed complete with electrical conduit/wiring and be provided with electrical access cut-outs for electrical wiring risers, to match the enclosure electrical access plates in size and location. Other cut-outs in the concrete pad may also be provided for piping/tubing connections, depending on the location of the connections. For details on locations of access plates and all electrical/piping/tubing hook-ups, refer to the general arrangement drawings in the installation appendix.

7.2. ENCLOSURE BOLT DOWN

The compressor enclosure and skid has provision for bolt down via bolt down lugs, with locations as shown in the general arrangement drawing. Ensure that all bolt-down lugs are located and used. The bolt-down lugs provide 1" (25.4 mm) diameter holes for 7/8" (22.2 mm) diameter studs. Studs can either be cast into the concrete foundation before the enclosure is positioned, or "Hilti" type fasteners can be used after the enclosure is located.

The concrete equipment foundation should be flat and level in accordance with standard machine mounting practices. If upon compressor start-up some vibration is present, the foundation should be inspected for hollows and shimmed. Immediately after shimming, with vibration readings within the 1.2 inches per second (30 mm/s), grout must be applied to a depth of 1 inch (25.4 mm) to all sections of the skid base to ensure that the shims maintain their adjustment positions.

Alternatively suspension isolation systems are available for compressors installed in above ground locations or areas sensitive to any vibration noise transfer. Consult the factory for available options and installation information.

8. PIPING PANEL INSTALLATION

If stand-alone Priority, ESD, or Time-Fill Control panels are supplied, they should be mounted in locations compatible with the enclosures they are ordered with. NEMA 4 or 3R enclosures are weatherproof and suitable for outdoor mounting. NEMA 12 and back pan panels must be mounted in suitable weather protected locations. Sufficient clearance should be maintained on all sides of the panel for piping and electrical connections if required. Provision should be given for panel maintenance by providing isolation ball valves as required. For enclosure size, mounting lug dimensions, and electrical/mechanical interconnection requirements, refer general arrangement drawings and schematics in the installation appendix. These panels contain natural gas and therefore any location where they are mounted will be classified as a hazardous location of at least class I, division 2, group D classification. Consideration must be given to electrical codes and installation codes as necessary for the jurisdiction of installation (ex. CAN/CGA-B149.1, CSA C22.1-94, NFPA 52, NFPA 70, etc.)

9. STORAGE CASCADE INSTALLATION

If stand-alone storage cascade pressure vessel rack assemblies or buffer pressure vessels are supplied, they must be mounted on a suitable concrete foundation designed for the maximum bearing weights of the rack end



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bulkheads. It is recommended that the concrete foundation be designed with a 2 degree slope toward the pressure vessel end with the drain port. This will facilitate periodic draining of liquids from the pressure vessels.

Holes for tie-down lugs are provided at the base of the bulkheads and are used to secure the rack assembly to the concrete foundation. Studs can be cast in the concrete to match the tie-down lug holes or "Hilti" type concrete fasteners can be used after the rack assembly is located.

Any and all relief valves must be provided with suitably sized vent piping according to applicable code requirements. Discharge flow reaction forces should be considered in the bracing of the vent piping. Vent piping must discharge in a non hazardous area as per code requirements.

Any ground storage pressure vessels must be protected from vehicular impact with bollards or as required by the applicable codes.

10. GAS SUPPLY PIPING

The gas supply piping from the meter/regulator set to the compressor enclosure must be adequately sized for the compressor inlet pressure and flow rate requirements. Pressure drop between the meter/regulator set and compressor inlet should not exceed 3 to 5 psig for inlet pressures below 200 psig. For very low inlet pressures of less than 25 psig, even a loss of 1-2 psig can have a significant effect on compressor flow capacity. To reduce pressure drop, pipe diameters must be up-sized for long piping runs. If a detectable pressure drop occurs, the meter regulator should be adjusted so that compressor inlet pressure is maintained during compressor operation.

10.1. CATHODIC PROTECTION

Buried gas supply piping must have cathodic protection according to the local code of jurisdiction. This requires the use of insulating flanges at the entrance and exit of the pipe from the ground and sacrificial anodes buried at intervals as required by the local code of installation.

10.2. FLEXIBLE COUPLING

It is advisable to install a short length of flexible hose between the enclosure inlet piping and the insulating flange coupling of the gas supply line. This will serve to isolate compressor vibration from gas supply piping.

10.3. ISOLATION VALVES

It is recommended that an isolation ball valve be installed just upstream of the flexible coupling on the gas supply line of each compressor.

10.4. FILTER METER MODULE

The gas supply piping should include a filter meter module according to the local code. IMW strongly recommends that the gas pipe line includes an adequate filter to provide a high quality of gas that is free of particles which could seriously damage the compressor components.

In some areas, a dryer is required where moisture is present in the gas stream.

The supplied filter and dryer (if applicable) have to be sized correctly to ensure enough gas flow with minimal pressure drop to the compressor inlet. It is advisable to check allowable pressure drop.

11. FIELD STORAGE CASCADE PIPING

Compressor stations with stand-alone storage cascades or buffer vessels require high pressure gas connections to be made to priority panels or time-fill panels. For the locations and sizes of these connections, refer to the general arrangement drawings in the installation appendix.

Field piping between compressor priority panel, storage bottles and dispensers should be installed using tubes or pipes that are rated for the maximum working pressure of the compressor discharge. If the tubing or piping distances are long, tubing and piping sizes should be increased to minimize pressure drop.

If a leak test is required, only nitrogen/air mixture should be used as the test medium and the tubes or pipes should be tested at one and a half times of the compressor maximum discharge pressure.



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12. FIELD DISPENSER PIPING

High pressure gas lines must be provided between any ground storage pressure vessels and the dispenser(s). The sizing of these lines is dependent on the flow performance of the CNG station equipment. For specific configuration, connection sizes and locations on all equipment refer to the general arrangement drawings in the installation appendix. If the tubing or piping distances are long, tubing and piping sizes should be increased to minimize pressure drop.

Each dispenser filter should have a needle valve drain in the bottom of the bowl to facilitate periodic condensate draining.

13. ELECTRICAL INSTALLATION REQUIREMENTS

13.1. AREA ELECTRICAL CLASSIFICATIONS

All electrical equipment within the compressor enclosure and near any gas-containing equipment is designed for Class I, Division 1 or 2, Group D hazardous locations. NOTE: Please reference the compressor or panel nameplate for the actual hazardous area classification as the divisions and classifications may change depending on specific design criteria. All electrical equipment within these areas is designed and wired explosion-proof or intrinsically safe explosion-proof. Intrinsically safe wiring is used with pressure and temperature sensors located inside the compressor enclosure, and uses Zener barriers to limit current in the field wiring. This prevents any spark occurring which might ignite gas.

Areas sufficiently far from gas containing equipment are considered non-hazardous and safe for locating such equipment as non-explosion-proof electrical panels. For precise area classifications refer to the local applicable installation codes (ex. For Canada, CAN/CGA B149.1-M91, Natural Gas Installation Code).



INSTALLATION AND PRESERVATION



WARNING –EXPLOSION HAZARD- SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2



AVERTISSEMENT - RISQUE D'EXPLOSION – LA SUBSTITUTION DE COMPOSANTES PEUT RENDRE L'ÉQUIPEMENT NON CONVENABLE POUR LA CLASSE I, DIVISION 2

Table 1: Division 2 Component Table

DESCRIPTION	REFERENCE DESIGNATION	APPLICABLE PRODUCT RATINGS
ENCLOSURE 16X12X6	120V J-BOX	CSA, Type 1, 3R, 4
RED PILOT LIGHT 120VAC LED CL1 DIV2	ALARM LIGHT	CE, CSA, UL, Class I Div 2 ABCD
GREEN PILOT LIGHT 120VAC LED	RUN/STANDBY LIGHT	CE, CSA, UL, Class I Div 2 ABCD
SWITCH OPERATOR 2 POSITION SELECTOR	SWITCH FOR SKID LIGHT	CE, CSA, UL, Class I Div 2 ABCD
CONTACT 1 N.O HERMETICALLY SEALED	CONTACT BLOCK FOR SKID LIGHT	CE, CSA, UL, Class I Div 2 ABCD
1NO 1NC CONTACT BLOCK	EMERGENCY SHUTDOWN CONTACT BLOCK	cULus, Class I Div 2
PUSH-PULL MUSHROOM OPERATOR	BUTTON FOR EMERGENCY SHUTDOWN	cULus, Class I Div 2
SELECTOR 2-POS STD-LVR BLK 2-MAINTAINED	ONLINE / OFFLINE SWITCH	UL, CSA, CE
PILOT BLOCK 1NO	CONTACT FOR ONLINE / OFFLINE SWITCH	CE, CSA, UL, Class I Div 2 ABCD
LIGHT CEILING STE 32W X 120V @60HZ 48IN	SKID LIGHT	cCSAus, Class I Zone 2, eX na II T4 BCD
GAS DETECTOR	GAS DETECTOR	UL, CSA, Class I Div 1 BCD
BOX JUNCTION CS 6.000 X 6.000 X 4.000	460V-480V J-BOX (FANS, SPACE HEATERS...)	cULus, Type 1, 3R, 4, 12
BOX ELECTRIC 10.000 X 8.000 X 6.000	INTRINSIC J-BOX	cULus, Type 1, 3R, 4, 12
COOLER MOTOR	COOLER MOTOR	CSA, UL, Class I Zone 1 CD
COOLER MOTOR/VENT FAN	COOLER MOTOR/VENT FAN	CSA, UL, Class I Zone 1 CD
MAIN ELECTRIC MOTOR	MAIN ELECTRIC MOTOR (M1, M2...)	cCSAus Class I Div 2, BCD
SOLENOID VALVE	SOLENOID VALVE	CSA, FM, Class I Div 1 ABCD
PRESSURE TRANSMITTER 0-500 PSIG	PRESSURE TRANSMITTER	cCSAus Class I Div 1 ABCDEFG
PRESSURE TRANSMITTER 0-1000 PSIG	PRESSURE TRANSMITTER	cCSAus Class I Div 1 ABCDEFG
PRESSURE TRANSMITTER 0-5000 PSIG	PRESSURE TRANSMITTER	cCSAus Class I Div 1 ABCDEFG
GAUGE PRES SWITCH	OIL PRESSURE	CSA, Class I Div 1 CD
GAUGE TEMP SWITCH	INTERSTAGE TEMPS	CSA, Class I Div 1 CD
DISCRETE ZENER BARRIER Z779.F	Z779.F	FM, CSA, Class I Div 2 ABCD
ANALOG ZENER BARRIER Z787.F	Z787.F	FM, CSA, Class I Div 2 ABCD



WARNING – EXPLOSION HAZARD – DO NOT REPLACE ANY ELECTRICAL EQUIPMENT IN A CLASSIFIED AREA UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.



AVERTISSEMENT - RISQUE D'EXPLOSION – NE REMPLACER AUCUN EQUIPEMENT ELECTRIQUE DANS UNE ZONE CLASSÉE, A MOINS QUE LE COURANT AIT ETE COUPE OU QU'IL S'AGISSE D'UN EMPLACEMENT NON DANGEREUX.



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13.2. ELECTRICAL CONTROL PANEL INSTALLATION

Applicable electrical controls (including those for compressors, dispensers, priority panels) with NEMA 12, 4 or 3R electrical panel enclosures must be located remotely from compressors and gas piping systems, in a non-hazardous area. NEMA 4 or 3R panels are weatherproof and are suitable for outdoor mounting. NEMA 4 or 3R panels subjected to cold winter temperatures should be equipped with thermostatically controlled space heaters. NEMA 12 panels should be mounted in a secure weatherproof building or special kiosk. The electrical control panel should be bolted to the floor or foundation upon which it sits.

13.3. ELECTRICAL FIELD WIRING CONNECTIONS

The installer must complete electrical connections from the remote electrical controls to the compressor, piping panels, and dispensers. Electrical connections can be made with hard wire and conduit or armoured type flexible cable conduit. Electrical cable runs must be buried 24" to 36" below grade. Connections at compressor, piping panel and dispensers are made with conduit and seals or connection glands at the appropriate explosion-proof junction boxes on the equipment.

Required electrical cable, junction box port sizes, and electrical termination details are provided in the equipment electrical installation drawings found in the installation appendix.

14. LONG TERM PRESERVATION PROCEDURE

For periods of storage exceeding 6 months, IMW recommends following the official IMW storage procedure, as found in the installation appendix.



SYSTEM OPERATION AND DESCRIPTION

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SYSTEM OPERATION AND DESCRIPTION

15. COMPRESSOR BLOCK

The IMW50 and IMW Alpha3 series compressors are heavy duty reciprocating compressors designed for intermittent or continuous running with minimal maintenance. This is apparent from the crosshead guided design and rugged air-cooled or water-cooled cylinders which provide unmatched heat transfer for long and reliable operation.

The typical compressor crankcase has two throws, for the Alpha3, or three throws, for the IMW50, with a crankshaft which is dynamically balanced, counter-weighted, and rides on two tapered roller bearings. Each throw is connected to a crosshead piston which reciprocates in a crosshead guide and provides linear guiding for the pistons of each stage. This manual only covers IMW50 and IMW Alpha3 compressors having non-lubricated pistons and seals.

Non-lubricated pistons and rod packing using seals and piston rings made of specialty plastics allow all IMW machines to compress gas without oil contamination of the gas stream. Piston rings are used to seal the gas on each stage and a rider ring acts as a linear bearing to center the piston in the cylinder bore. The number and types of rings used in each stage is determined by the operating parameters (primarily pressure) of the stage.

Rod packing is of a radial tangential type, each with its own packing cup and stacked inside a seal carrier. Each piston rod has a seal carrier assembly which provides gas sealing of the piston rod. The first seal of the seal stack at the crosshead end is a rod oil wiper, which cleans the rod of crankcase oil. A vent ring is located above the rod wiper ring sealing vent gas from entering the crankcase. On IMW50 compressors a vent block is located between the vent ring and radial/tangential rod seals and allows a very small amount of gas to seep out the vent port in the seal carrier. IMW Alpha3 compressors have a full distance piece, which also acts as a gas vent block and oil drain block. This distance piece is located similarly to the vent block of the IMW50. The vent port is routed with tubing into the crankcase of the compressor, and then to a vent header. This allows this gas to vent safely to atmosphere.

All stages use specially designed compressor valves to control gas flow in each stage of the compressor. Double acting (DA) cylinders use two or four suction valves and two or four discharge valves per stage. Single acting cylinders with compression to the crank end (SACE) use a single pair of suction and discharge valves. Single acting cylinders with compression toward the head end (SAHE) use a single concentric valve with both suction and discharge valves in one valve body.

The compressor is driven by an electric motor or gas engine which is foot-mounted on the compressor skid. Power transmission to the compressor is via multi-band V-belts and sheaves.

For compressor block part numbers and assembly diagrams, refer to the service appendix.



SYSTEM OPERATION AND DESCRIPTION

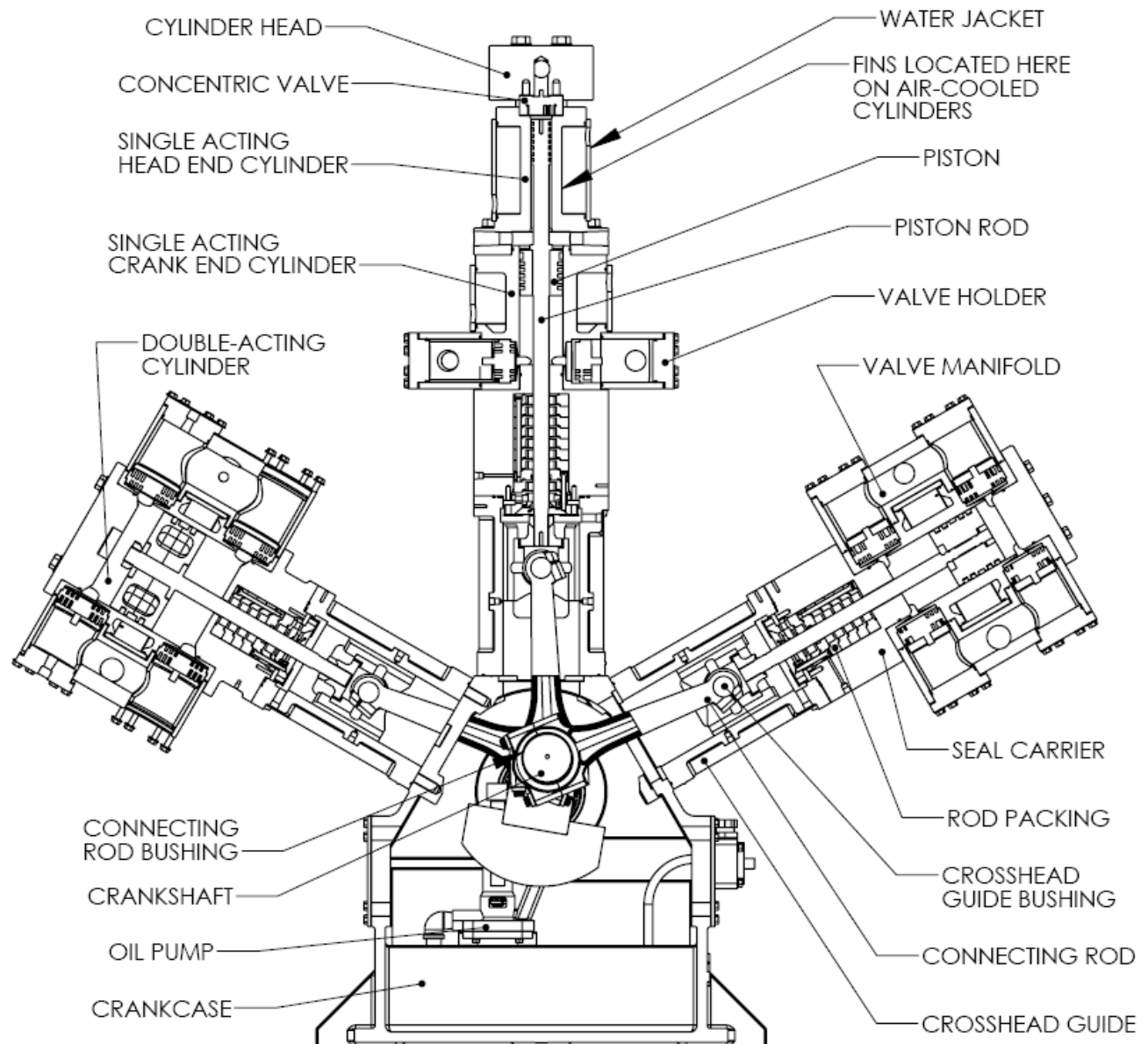


Figure 1: IMW50 Internals - Water-cooled Configuration



SYSTEM OPERATION AND DESCRIPTION

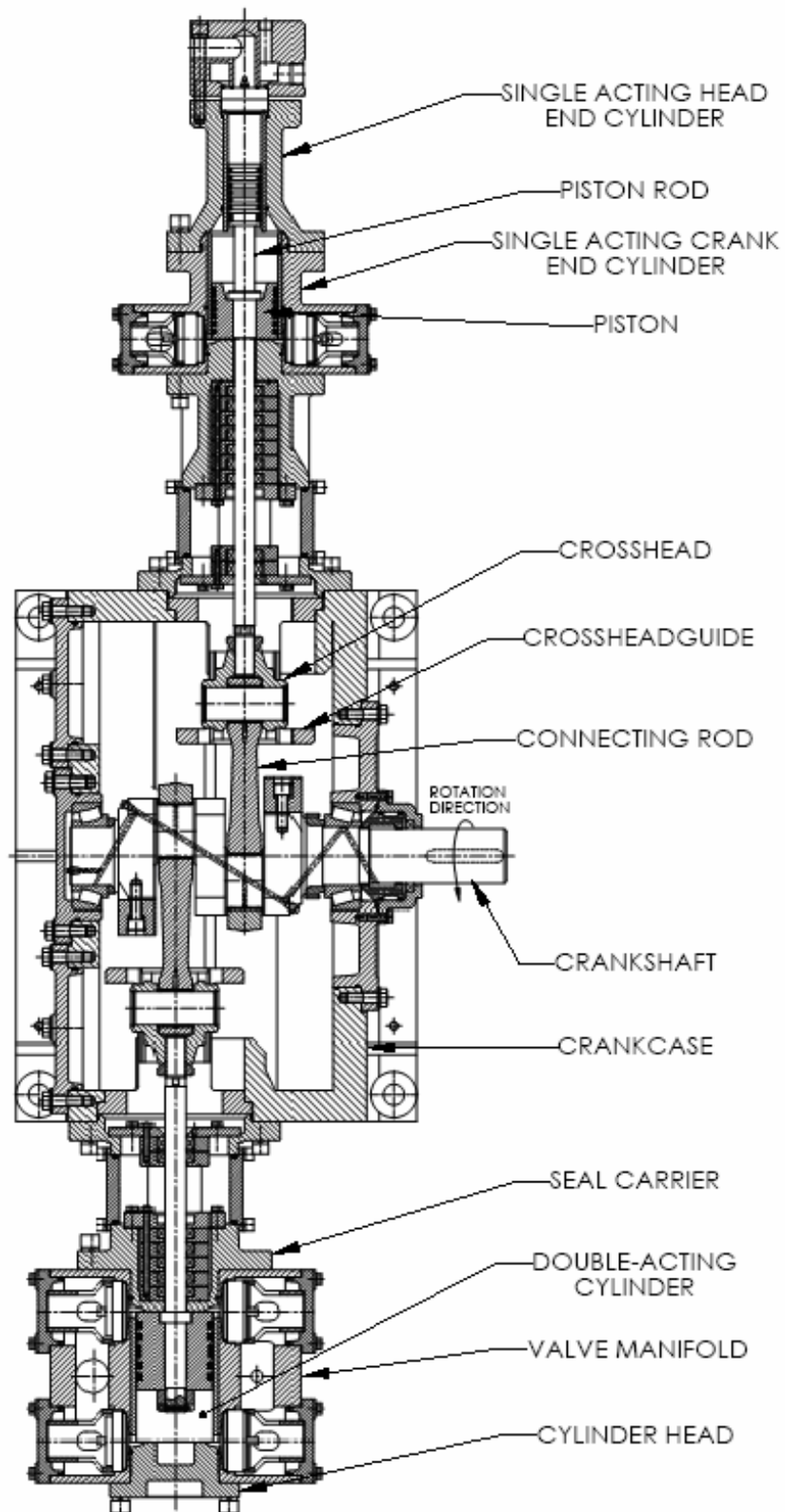


Figure 2: Alpha3 Internals



SYSTEM OPERATION AND DESCRIPTION

16. COMPRESSOR INTERSTAGE PIPING

The inlet line to the compressor is connected to the natural gas metering system of the local gas authority. Some installations may have a gas dryer between the compressor and the gas meter. The gas flowing to the compressor passes through an on-skid failsafe closed inlet valve which isolates the compressor from the gas supply whenever the compressor is shut down.

Supply gas is also filtered before the compressor through an inlet filter for the removal of small particles of dirt and dust. The filter also damps out pressure pulses created by the reciprocating of the pistons for the protection of the gas supply meter/regulator set.

Gas enters the first stage of the compressor and is compressed. Discharge gas from the first stage is hot and flows through a gas heat exchanger. Gas flowing through the heat exchanger travels through tubes which are cooled by a stream of air propelled by a fan, or a water jacket heat exchanger provided with external cooling tower. As the gas exits from the heat exchanger it has been cooled for the next stage of compression.

From the heat exchanger the gas enters the first stage scrubber which removes entrained hydrocarbons, condensed water, and any large particles. In addition, the scrubber vessel provides inter-stage pulsation damping.

The gas then enters the second stage of the compressor where it is compressed to an even higher pressure. The discharge gas is hot once again and enters a second heat exchanger stage for cooling. This same process is repeated with subsequent stages. After the final stage the gas flows through a final filter, cleaning the gas of any entrained hydrocarbons, condensates and oil.

A complete pressure and temperature gauge panel is provided for the monitoring of inter-stage gas pressures and temperatures. The temperature gauges are electrical switch gauges and provide a system shut down signal in the event that stage gas temperatures exceed an acceptable limit. Pressure switch gauges and sensors are also provided for the monitoring of lubrication pressures and gas pressures as specified. Specific instrumentation provided can be determined from the specific equipment drawings as provided in the service and installation appendices.

All inter-stage piping is protected from over-pressurizing with inter-stage safety relief valves. All relief valves are vented to atmosphere through a common vent header or common discharge pipe for discharge at a safe location.

The vent header serves as a manifold for vent gas as well as the inlet filter, scrubbers and final separator manual drain valves.

Compressor inter-stage piping is either fabricated and joined using socket weld joint connections or piped using flanged tube fittings. All piping and tubing is designed, manufactured and tested in accordance with code requirements as specified.

16.1. COMPRESSOR BLOW DOWN AND GAS RECOVERY

After the gas's final pass through the after-cooler, a line is taken off through a pilot operated drain valve to the recovery tank (see equipment flow schematic drawings). This drain valve is pilot operated with a 3-way solenoid valve. The solenoid valve uses a tiny amount of gas taken from a storage bank or compressed air, which is stepped down in pressure through a reducing regulator. During normal compressor operations the 3-way solenoid valve is energized to close the drain valve. As soon as the compressor stops, the 3-way solenoid valve is de-energized, causing the pilot gas to vent from the drain valve. The drain valve opens and allows gas pressurized inside the compressor block and inter-stage piping to flow into the recovery tank. In this way the compressor block unloads itself from pressurized gas on shut down, without venting large quantities of gas to atmosphere. This method also eliminates high start up loads.

The outlet line of the recovery tank is connected to the compressor inlet line through an orifice and valve just downstream of the inlet valve. The recovery tank orifice reduces recovery tank gas pressure to that of inlet pressure. Upon compressor start up, the drain valve closes and the recovery tank valve opens allowing the recovery tank to drain gas into the compressor inlet line. Therefore, the recovery tank valve closes upon compressor shut down and opens on compressor start up. In some cases, the recovery tank orifice is replaced by a needle valve or a regulator to regulate the gas from the recovery tank to the inlet line.



SYSTEM OPERATION AND DESCRIPTION

17. COMPRESSOR LUBRICATION SYSTEM

The IMW50 and Alpha3 series compressors use a pressurized lubrication system for the lubrication of the connecting rod, crankshaft bearings and crosshead guides.

The IMW50 compressor block uses a gear oil pump. The oil system working pressure is between 40 to 60 psig, and the compressor should shut down at 25 psig. The oil is filtered then using an oil introducing ring, oil is supplied to lubricate crankshaft, main bearings and connecting rods shell bearings.

Lubrication for crossheads is supplied by either of two ways: internally through oil galleries in the connecting rods then through wrist pins to crosshead surfaces; or externally, where the filtered oil is supplied to a distribution manifold block, then to lubrication ports located in the crosshead guides. Internal lubrication is used in throws with double acting cylinders or stepped cylinders. External lubrication is used in throws having single acting cylinders.

The IMW Alpha3 compressor block also uses a gear oil pump; however, the oil system working pressure is between 50 to 80 psig, and the compressor should shut down at 40 psig. The oil is filtered, and then at the manifold the flow passes through the oil cooler (as mentioned below). After exiting the cooler, the oil is then sent to the crankshaft via the labyrinth seal, through the crankshaft to the connecting rods, and also to the crossheads and crosshead guides.



CAUTION: THE OIL PUMP USED INSIDE AN ALPHA3 COMPRESSOR BLOCK IS UNIDIRECTIONAL. THE COMPRESSOR MUST ROTATE IN AN ANTI-CLOCKWISE DIRECTION FACING THE FLYWHEEL. ANY REVERSED ROTATION WILL RESULT IN A LACK OF LUBRICATION OIL AND DAMAGE TO THE BLOCK.

18. COMPRESSOR COOLING SYSTEM

An air-cooled compressor cooling system consists of extruded aluminum-finned tube heat exchanger sections through which the inter-stage gas flows in multiple passes. Air circulation over the heat exchanger sections is provided by electrically driven shrouded fans.

A water-cooled compressor cooling system consists of shell-tube heat exchanger sections through which the inter-stage gas passes. Water circulation through the shell is provided by a water pump. The water from the shells is circulated through a plate heat exchanger, completing the closed-loop circuit on the compressor. The plate heat exchanger may then couple to an open-loop system with a water tower.

Air-cooled gas cylinders are of a finned design that allows for the effective expulsion of heat to the atmosphere. For the water-cooled cylinders, a heat exchanger section is included in the heat exchanger assembly to transmit heat from the cylinder coolant. Depending on the size of the compressor, an oil heat exchanger section may also be included.

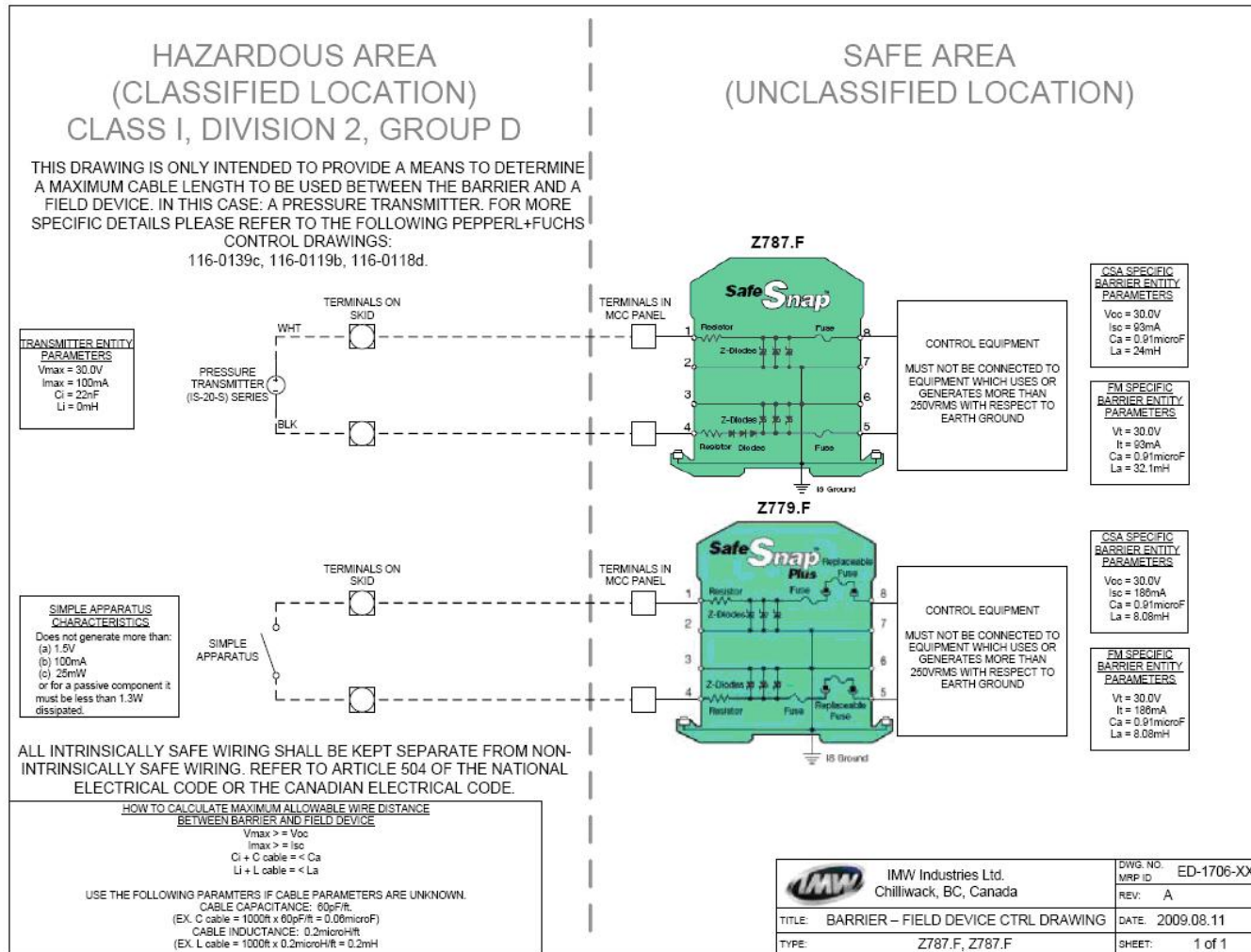
19. COMPRESSOR ELECTRICAL CONTROLS

19.1. COMPRESSOR CONTROL

Compressor operating logic is controlled by a programmable logic controller (PLC). The PLC starts and stops the compressor, continuously monitors compressor status and indicates alarm conditions. Compressor status is monitored by various sensors for pressure, temperature, flow and other data as required. Certain sensors and switches are monitored through Zener barriers, which limit current in the field wiring, making these circuits intrinsically safe. All other switches, motors and solenoid valves used to run the compressors are all wired using approved methods specific for that classification. Please reference the IMW control drawing ED-1706-XX that follows for determining proper connection techniques between the barriers and field devices.



SYSTEM OPERATION AND DESCRIPTION



All compressor systems will have an ESD (Emergency Shut Down) system that incorporates red mushroom pushbuttons in key positions. This system will safely shut down the compressor and all sources of gas such as the inlet pipeline and the storage to dispenser lines. An Online / Offline switch is located both in the compressor and on the control panel. Both of these switches must be in the online position for the compressor to function automatically. Placing either of these switches in the Offline position will stop the compressor and it will remain off until both switches are returned to the online position. This should NOT be used as a disconnect switch and is not safe to work on any rotating equipment. The correct safe method for maintenance is: turn off the main breaker on the electrical panel and lock the breaker out.

19.2. COMPRESSOR OPERATION

19.2.1. Starting

With the compressor online and all alarms cleared, the screen will indicate "Ready to Run" and the green lamp in the compressor skid will be flashing. If the storage pressure in the selected storage bank/s drops below the selected start pressure the machine will start. The cooler fan will start; the recovery tank valve will open if the suction line requires more pressure. After 10 seconds the suction valve will open and 2 seconds after that the main motor or engine will start. The main motor is given about 5 seconds to ramp up to speed and start compressing. The recovery tank valve will re-open (if it was closed) feeding any recovery tank gas back into the suction line.



SYSTEM OPERATION AND DESCRIPTION

19.2.2. Running

Every 20 minutes of continuous compression, on air-cooled compressors, the cooler fan will stop for a 30 second period. If the skid has the gas detector option, a leak will become evident during this time as the air flow through the skid will stop. If the gas concentration rises above 20% LEL (factory default) the screen will show a Warning Gas Level #1 Alarm. If it rises to 40% LEL (factory default) the compressor will shut down and show the Gas Level #2 Alarm. Once the compressor shuts down the vent fan will turn on continuing to evacuate the skid and will stay on until the gas level drops below 5% LEL.

19.2.3. Stopping

When the storage pressure in the selected storage bank/s rises to the selected stop pressure the compressor will stop, closing the recovery tank and suction valves and opening the auto-drain valve. The cooler will run for 15 seconds after the compressor stops. The auto-drain valve will remain open for 4 minutes to completely equalize the discharge pressure into the recovery tank, allowing the next start to be unloaded. Some systems may have additional operating logic controlling system operation including remote authorization switches and lead-lag systems for multiple compressor installations.

19.2.4. Screen Operation

Typically the control panel will have some type of HMI (Human Machine Interface) usually in the form of a screen with function keys as shown below. In this case the screen is touching sensitive. This means that you simply touch certain areas of the screen to perform a function.

19.2.4.1. Main Menu

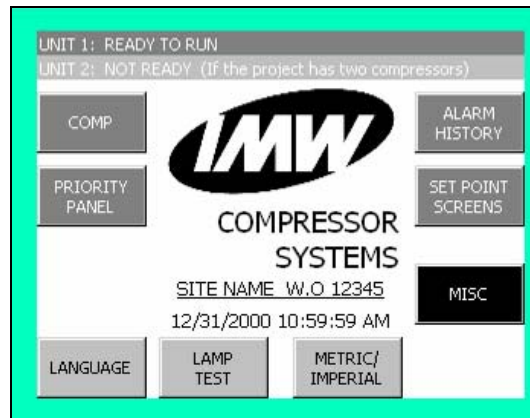


Figure 3: HMI Main Menu

- The compressor status is shown at the top of each screen.
- The center of the main menu will show the compressor serial number, site name (if available) and date / time.
- By touching one of the corresponding function keys the screen will change to display the required information.
- In most cases there will be one or more constant keys at the bottom and will perform the same function in each screen. These will be functions such as:
 - “LANGUAGE” (on some projects): Toggles between English and a different language.
 - “LAMP TEST”: While pushed illuminates all lamps on the control cabinet and skid.



SYSTEM OPERATION AND DESCRIPTION

- “METRIC/IMPERIAL”: Toggles between imperial (Pressure in PSI & Temperature in F) and metric (Pressure in BAR & Temperature in C)
- “MAIN MENU”: Returns to main menu (shown above).

19.2.4.2. Compressor

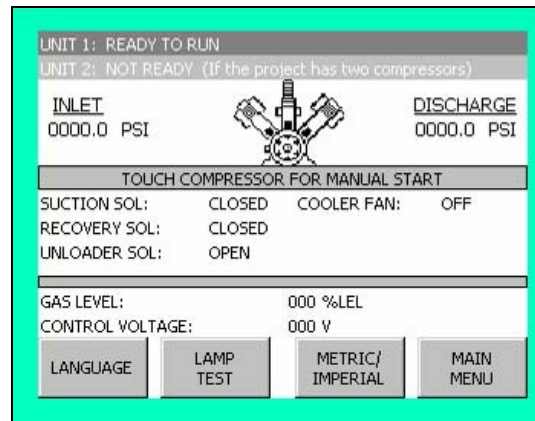


Figure 4: HMI Compressor Screen

- The compressor status is shown at the top of each screen.
- Compressor Suction (Inlet) pressure in PSI or BAR.
- Compressor Discharge pressure in PSI or BAR.
- To start the compressor manually, simply touch the picture of the compressor. (The compressor will not start if it is not ready to run, or if storage is full)
- Valve and fan status are displayed
- Gas level (if applicable) in %LEL (Lower Explosive Limit).
- Voltage (if applicable).

19.2.4.3. Priority Panel

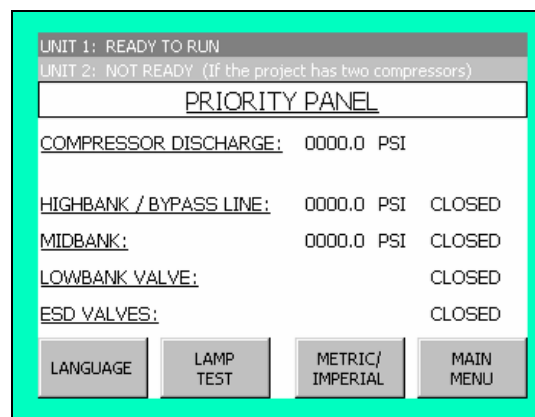


Figure 5: HMI Priority Panel Screen

- The compressor status is shown at the top of each screen.



SYSTEM OPERATION AND DESCRIPTION

- Open / Closed state of each valve.
- Priority Panel pressures, Bypass, Mid-bank and Low-bank all in PSI (if applicable).
- Buffer and line pressures (if applicable).

19.2.4.4. Alarm History

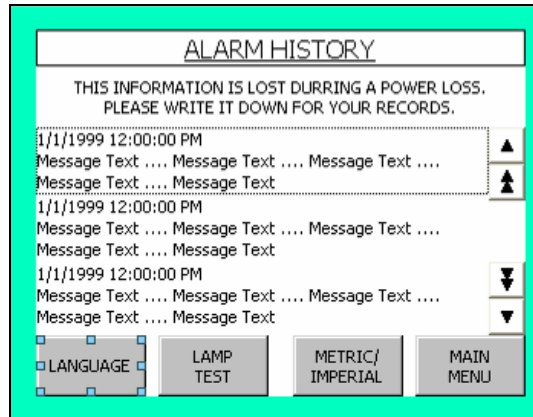


Figure 6: HMI Alarm History Screen

- The Alarm History screen shows the last 25 alarms that have occurred. They are stored in the screen itself with a Date / Time stamp for each alarm.
- NOTE: The alarm history is lost if the control power is lost.
- To scroll through the 25 alarms simply use the Up and Down arrows.
- Once full, the newest alarm will be placed at the top of the list bumping each alarm down one, deleting the oldest.

19.2.4.5. Setpoints

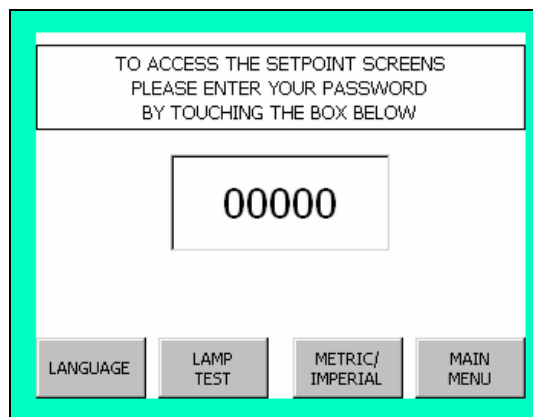


Figure 7: HMI Setpoint Password Entry Screen

NOTE: Incorrect setting of these setpoints can result in erratic compressor function or damage to the machine! Trained and Authorized personnel only should be allowed access!

- On the Main Menu when the “SET POINT SCREENS” button is pushed you will be asked for a password. This is designed to stop unauthorized access the setpoint screens.
- Setpoints can only be displayed and entered in imperial units (Pressure in PSI & Temperature in F)



SYSTEM OPERATION AND DESCRIPTION

SETPOINTS 1	SETPOINT	DEFAULT
SCALE U1 SUC PT:	0000	PSI 0000
SCALE U1 DISC PT:	0000	PSI 0000
UNIT 1 STARTS 000000000		
LANGUAGE	CHANGE PASSWORD	NEXT SCREEN
MAIN MENU		

Figure 8: HMI Setpoints Screen

- Use the "NEXT SCREEN" and "PREVIOUS SCREEN" buttons to navigate through the setpoints screens.
- To change a setpoint: Select it by touching the setpoint; a numeric entry screen will appear, enter the new value and press <Enter>. NOTE: you must enter a value within the minimum and maximum allowable values. You will see the new value displayed in the setpoints column once it has been accepted by the controller.
- This screen is used to set the unit 1 scaling (the pressure range that the analog signal is converted to) of each unit pressure transmitter. (ex. if the suction transmitter has a 0-300psi range, the setpoint should be set to 300)
- The SETPOINT column shows the value that the PLC is actually using to scale each transmitter.
- The DEFAULT column is the value that was factory set to match the factory transmitters.
- UNIT 1 STARTS shows the number of starts to date that a unit has.

SETPOINTS 2	SETPOINT	DEFAULT
U1 START PRESSURE	0000	PSI 0000
U1 START BANK 1-3	0	# 0
BANK SELECTION: 1 = HB, 2 = MB, 3 = HB OR MB		
U1 STOP PRESSURE	0000	PSI 0000
U1 STOP BANK 1-3	0	# 0
U1 RE-CIRC TIME:	0000	SEC 0000
LANGUAGE	PREVIOUS SCREEN	NEXT SCREEN
MAIN MENU		

Figure 9: HMI Setpoints Screen

- Start Pressure is the pressure value that will start the compressor. (falling)
- Stop Pressure is the pressure value that will stop the compressor. (rising)
- Start / Stop bank = number between 1 & 3 and in some cases 1 & 7.



SYSTEM OPERATION AND DESCRIPTION

Table 2: Storage Bank Identifiers

NUMBER	BANK(S) TO BE USED
1	High Bank Only
2	Mid Bank Only
3	High or Mid Bank
4	Low Bank Only (if applicable)
5	High or Low Bank (if applicable)
6	Mid or Low Bank (if applicable)
7	Any Bank (if applicable)

- Re-Circ Time “Re-circulation” is the amount of time that the unit will run after compression is complete (sometimes called cool time). Not all units have re-circulation.

SETPOINTS 5	SETPOINT	DEFAULT
SCALE BYPASS PT:	0000 PSI	0000
SCALE MIDBANK PT:	0000 PSI	0000

LANGUAGE PREVIOUS SCREEN NEXT SCREEN MAIN MENU

Figure 10: HMI Priority Panel Setpoints

- This screen is used to set the priority panel scaling (the pressure range that the analog signal is converted to) of each unit pressure transmitter.



SYSTEM OPERATION AND DESCRIPTION

SETPOINTS 6	SETPOINT	DEFAULT
BYP - HB RISING P:	<input type="text" value="0000"/>	PSI 0000
BYP - HB FALLING P:	<input type="text" value="0000"/>	PSI 0000
HB - MB RISING P:	<input type="text" value="0000"/>	PSI 0000
HB - MB FALLING P:	<input type="text" value="0000"/>	PSI 0000
MB - LB RISING P:	<input type="text" value="0000"/>	PSI 0000
MB - LB FALLING P:	<input type="text" value="0000"/>	PSI 0000

Figure 11: HMI Priority Panel Rising/Falling Setpoints

- A Priority Panel rising setpoint is the pressure value at which the next storage bank value will open. (ex. If the bypass pressure rises to it's rising setpoint the high bank valve will open)
- A Priority Panel falling setpoint is the pressure value at which the next storage bank value will close re-directing the fill back to the higher priority. (ex. If the bypass pressure falls to it's falling setpoint the high bank valve will close)

SETPOINTS 8	SETPOINT	DEFAULT
GAS WARNING:	<input type="text" value="000"/>	%LEL 000
GAS ALARM:	<input type="text" value="000"/>	%LEL 000

Figure 12: Gas Warning Setpoints

- Gas Warning (Level 1) is the % of LEL that will start the vent or cooler fan (If applicable and the compressor is not running) and display a Warning on the screen. (The compressor does not shut down)
- Gas Alarm (Level 2) is the % of LEL that will shut down the compressor and display as an Alarm.



SYSTEM OPERATION AND DESCRIPTION

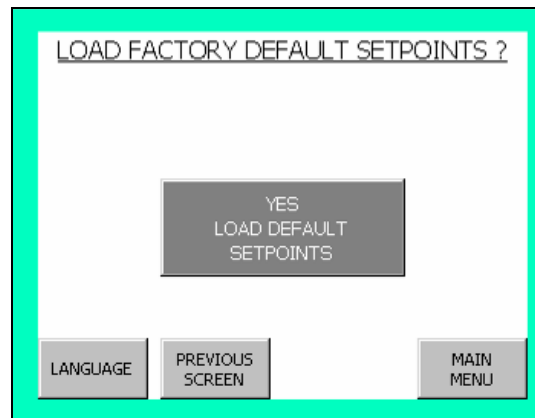


Figure 13: Factory Default Setpoints

- The last setpoints screen gives the option to load all the factory default settings.
- “YES LOAD DEFALT SETPOINTS” button will load all factory default setpoints. This will overwrite any of the setpoints that have been previously changed with the value shown in the default column.
- “PREVIOUS SCREEN button will NOT load the factory defaults and will return to the previous screen.

19.3. COMPRESSOR CONTROL RESET

When the compressor controls have registered an alarm and the fault condition has been corrected, the compressor cannot resume operation until the compressor controls have been reset. BEFORE RESETTING, MAKE SURE ALL TOOLS AND PERSONNEL ARE CLEAR OF THE COMPRESSOR! To reset, acknowledge any alarms being displayed on the screen and simply push the green reset button on the control panel. The compressor will return to the “Ready to Run” state and automatically start when required or be started using the “Manual Start” function key.

19.4. COMPRESSOR ALARMS

If any of the compressor sensors signal a fault condition to the PLC, the compressor will shut down and a red alarm light will light up at the control panel and at the compressor skid (if applicable).

When the PLC registers an alarm, the alarm will be displayed on the control panel screen until it is acknowledged. The compressor will not start up until the fault condition has been corrected and the compressor control panel has been reset. Even if the alarm condition clears itself, the indicator light(s) remain illuminated until the control panel is reset.

19.5. IMW OPTIONAL EQUIPMENT VOLTAGE MONITOR AND UPS

A voltage monitor can be installed as part of the control system to ensure the compressor motors and all electrical parts are supplied the correct voltage for their operation. The voltage monitor is set to trigger an alarm when the line voltage rises above or falls below 15% of the rated voltage. Also included with this option is phase loss and phase rotation protection. In the event of a phase loss or a change in rotation, an alarm will be triggered. When the system voltage drops below the set point value, the phase rotation is incorrect, or there is a phase loss, the following events will take place:

1. A system alarm or warning will be generated and the compressor may stop (depending on the unit).
2. A message will be displayed on the HMI “VOLTAGE OUT OF RANGE”, or “INCORRECT PHASE ROTATION”.
3. The operator will need to ensure that the system voltage is back to normal operating conditions before the system is restarted. The Voltage/Phase monitor may need to be reset manually (depending on the unit).



SYSTEM OPERATION AND DESCRIPTION

4. The operator must acknowledge the alarm through the HMI and press the reset button in order to return to system online condition (if it has stopped).
5. If the voltage monitor is removed or by-passed damage can occur if the voltage is out of range.

A UPS is required for the PLC, ESD circuit and dispenser electronics. If not purchased from IMW, it is the client's responsibility to install a UPS that meets IMW specifications. Operation of the compressor system without a UPS per IMW specification will void the warranty on any PLC, instrumentation, and dispenser electrical / electronic components.

A UPS is added to provide clean power to all PLC and Dispenser circuitry and in the event of a power failure prevent these devices from powering down. The UPS is carefully selected by IMW based on the voltage requirements of the system, it is not recommended to attach additional devices to the UPS without first consulting an IMW representative.

The UPS is capable of supplying the dispensers with auxiliary power¹ in the event of a power failure; this provides the station operator the benefit of continuing to sell gas until the pressure in the storage tanks has depleted.

19.6. CUSTOMER UPS INSTALLATIONS

This section applies when IMW does not supply the UPS. Every IMW compressor requires a UPS system. This is mainly to provide "clean" 120V to our control system. This document is designed to ensure that our customers provide a proper UPS system to maintain the protection that is required to avoid damage to any of the electronic equipment. Any customer supplied UPS should be of a commercial grade and be able to accommodate the most extreme conditions that could be present at any given time.

19.6.1. UPS Requirements

Any customer supplied UPS shall meet or exceed the following requirements:

19.6.1.1. Input

1. Power requirements should meet the Electrical Control Panel Schematic requirements. For Example: 1500 VA
2. Frequency: 50Hz or 60Hz
3. Frequency Window: 45-65 Hz
4. Synchronization Window: +/- 3Hz
5. Power Factor: .97

19.6.1.2. Output

1. Voltage Regulation: +/- 2% (117.6-122.4 Vac)
2. Output Voltage Waveform: Sine Wave
3. Frequency Regulation: +/- 0.25Hz (Battery or Free Run Mode)
4. Voltage Distortion-THD: <3% Linear Load, <5% Non-linear Load
5. Transient Response: 4% (100% Load Change)
6. Overload Capacity: 125% for 1 min. / 150% for 10 sec.
7. Crest Factor: 3 to 1
8. Efficiency: >86%

¹ Adding a larger UPS will allow additional standby time, ask your IMW representative for further details.



SYSTEM OPERATION AND DESCRIPTION

19.6.1.3. Protection

The UPS should protect against the following:

- Output Short Circuit
- Abnormal Voltage
- Abnormal Frequency
- I/O Noise
- I/O Spike and Transient
- Complete Battery Drain

19.6.2. Installation

IMW control panels are designed to support the UPS system and are supplied with customer interconnection terminals to allow for ease of installation.

A typical IMW control panel will have a vertical row of Red terminals. Included in this row is a set of terminals labelled '100', 'N', 'X1', and 'X2'. There is also a label beside terminals '100' and 'N' that reads "From UPS" and beside 'X1' and 'X2' that reads "To UPS".

If the input power for the UPS is from the IMW control panel then the terminals used for this are 'X1' and 'X2'. If the power is from an external supply (not the IMW control panel) then the customer is required to ensure that regardless of the input voltage, the output voltage will be 120 volts. The output of the UPS is to be terminated to terminals '100' and 'N'. If the IMW control panel comes with a receptacle and an electrical cord on the side of the enclosure, the UPS is ready to be plugged in directly.



SYSTEM OPERATION AND DESCRIPTION

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20. INTRODUCTION

The following are general maintenance instructions for the compressor system. For specific details of maintenance procedures please call IMW Aftermarket Sales and Service. Certain components may not apply to the supplied system.



WARNING –EXPLOSION HAZARD- SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2



AVERTISSEMENT - RISQUE D'EXPLOSION – LA SUBSTITUTION DE COMPOSANTES PEUT RENDRE L'ÉQUIPEMENT NON CONVENABLE POUR LA CLASSE I, DIVISION 2



WARNING – EXPLOSION HAZARD – DO NOT REPLACE ANY ELECTRICAL EQUIPMENT IN A CLASSIFIED AREA UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.



AVERTISSEMENT - RISQUE D'EXPLOSION – NE REMPLACER AUCUN EQUIPEMENT ELECTRIQUE DANS UNE ZONE CLASSÉE, A MOINS QUE LE COURANT AIT ETE COUPE OU QU'IL S'AGISSE D'UN EMPLACEMENT NON DANGEREUX.

21. TEMPERATURE SWITCH GAUGES

Inter-stage and coolant temperature switch gauges measure gas discharge temperatures from each stage using capillary tubes. The capillary tube sensors are inserted into stainless steel thermo wells and are mounted into the gas/coolant discharge piping on the hot side of the heat exchanger of each stage. Each inter-stage temperature switch gauge has a set point screw for manual adjustment. If the discharge gas temperature ever rises to the set point temperature, the compressor will safely shut down before any damage is incurred.

As part of a scheduled maintenance and service program inter-stage temperatures should be checked and recorded every 2 weeks. In addition, it is recommended that all set points be tested for correct compressor shutdown. The interval for this test is specified in the station maintenance schedule at the end of this section.

22. LUBRICATION OIL PRESSURE SWITCH GAUGE

The lubrication oil pressure switch gauge is located on the compressor gauge panel and monitors the oil pressures of the lubrication system. If there is a failure of the lubrication systems resulting in a loss of oil pressure the pressure switch gauges will send a signal to the compressor control panel to shut down the compressor. The pressure switch gauge has a shutdown set point as indicated on the lubrication system equipment bill of materials. It is recommended that these shutdown set points be tested every 500 hours as part of a regular maintenance and service schedule.



23. PRESSURE TRANSMITTERS

The inlet and discharge pressure transmitters sense pressure via a line taken prior to the first compression stage and after the discharge filter respectively. Both transmit a signal to the PLC. The PLC compares the signal from a pressure transmitter with both a high and a low pressure set point. If the inlet pressure rises to the high pressure set point, or drops to the low pressure set point, the compressor will be shut down safely.

It is recommended that all set points be tested for correct compressor shutdown at the interval specified in the station maintenance schedule at the end of this section.

24. RELIEF VALVES

Relief valves provide over-pressure protection to the pressure-containing components of the CNG station such as piping, pressure vessels, fittings, and compressor cylinders. It is most likely that in the case of compressor mechanical or electrical failure, the compressor will shutdown safely long before over-pressurization of any component can occur. It is in the unlikely event of sensor or electrical control failure that the relief valves will safely vent gas, preventing component over-pressurization. Each relief valve discharge port is piped either directly or via a vent header out to atmosphere for gas venting in a safe location well above grade.

Relief valves are adjusted and tested at the factory to vent gas at a precise pressure setting as determined by the maximum working pressures of the components it is protecting.



CAUTION:
NEVER TAMPER WITH A RELIEF VALVE!

It is recommended that pressure relief valves should be removed and tested by a certified relief valve testing shop at regular intervals per local safety codes and standards. If a valve fails to lift at its rated pressure, it must be readjusted and, if necessary, serviced or replaced.



CAUTION: IF A RELIEF VALVE HAS BEEN REMOVED, DO NOT PLUG THE RELIEF VALVE PORT. DO NOT OPERATE THE COMPRESSOR. LOCK OUT THE COMPRESSOR CONTROLS.

25. FILTERS

25.1. INLET FILTER

The inlet filter provides particulate filtering of inlet gas to the compressor. It also functions as a condensate trap and therefore requires draining every 2 weeks as part of a scheduled maintenance and service program.

To drain the inlet filter use the following procedure:

1. Shut down the compressor.
2. Open the inlet filter drain valve on the bottom of the filter housing or vent header and allow the collected condensates to drain into the vent header.
3. Close the inlet filter drain valve.

It is recommended that the inlet filter cartridge be changed and inspected 25 hours after start-up and commission of the compressor station. Thereafter, the inlet filter cartridge should be changed and inspected every 50 hours until 475 hours after start-up. The change and inspection may then be completed every 1000 hours as part of a scheduled maintenance and service program.

Prior to changing the inlet filter cartridge, the system should be shut down, drain valves should be opened and the system should be vented.

25.2. DISCHARGE FILTER

The discharge filter contains a coalescing filter cartridge which provides final filtration for the removal of entrained hydrocarbons, condensates and oil.



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A filter without automatic drain systems must be drained every 2 weeks as part of a scheduled maintenance and service program. To drain the final filter, use the following procedure:

1. Shut down the compressor.
2. Open the drain valve on the bottom of the filter housing bowl and allow the condensate to drain.
3. Close the drain valve.

It is recommended that the final filter cartridge be changed and inspected every 1000 hours as part of a scheduled maintenance and service program.

Prior to changing the discharge filter cartridge, the system should be shut down, drain valves should be open and the system should be vented.

26. SCRUBBERS

Scrubbers are small pressure vessels located in the compressor inter-stage piping, between the heat exchanger and the compressor suction inlet of all stages. The scrubber serves as a condensate trap and coarse particulate filter. In addition, it provides pulsation damping for the inlet of the compressor stage. For compressors without automatic draining systems the scrubbers need to be drained of condensate every 2 weeks as part of a scheduled maintenance and service program.

To drain the scrubbers, use the following procedure:

1. Shut down the compressor.
2. Open the drain valve of the first stage scrubber first, and allow it to drain. Close the drain valve.
3. Repeat this draining procedure for all higher stage scrubbers in sequence. Close drain valves as soon as draining is complete.
4. Start up compressor.

27. VENT HEADER

A vent header may be used to manifold all drain valves and relief valve vent piping into a common conduit for safe venting to atmosphere. The vent header is also a common collector for all condensates drained from scrubbers and filters. As part of a scheduled maintenance and service program the vent header should be drained every 2 weeks. To drain the vent header a drain ball valve is located at the base of the header.

28. RECOVERY TANK

The recovery tank is a large pressure vessel which collects blow down gas from the compressor when it shuts down. It may also be used for a condensate sump on systems with an automatic filter and scrubber drain system. Condensates collected in this tank require draining every 2 weeks as part of a scheduled maintenance and service program.

To drain the recovery tank:

1. Place a bucket below the drain valve.
2. Throttle the valve open until no more condensate drains.
3. Close the valve.

29. COOLING SYSTEM

Hot gas discharged from each cylinder enters the inter-cooler(s) and after-cooler for cooling between compression stages and after the final compression stage.

29.1. WATER-COOLED SYSTEMS

Water cooled compressors have open-loop and closed-loop cooling circuits. A closed-loop circuit uses a water/glycol mixture for cooling fluid. The closed loop system includes:

- a water pump,



- a coolant make-up tank,
- a flow switch,
- a plate heat exchanger,
- shell and tube heat exchanger sections, and
- a pressure relief valve.

The open loop system includes a:

- cooling tower,
- plate heat exchanger,
- cooling tower fan, and
- cooling tower pump.

Each of these items operates as detailed below.

29.1.1. Water Pump

The water pump circulates the coolant to different areas of the system. The rotation direction of this pump should be verified for pump replacement.

29.1.2. Coolant Make-Up Tank

The coolant make-up tank acts as a coolant reservoir for the system. Make sure that the coolant level shows $\frac{3}{4}$ fill on the sight glass.

29.1.3. Flow Switch

The coolant flow switch is mounted in the water discharge header and monitors coolant flow. In the case of a cooling system failure, causing insufficient coolant flow, the compressor will be safely shutdown on an alarm condition.

The coolant flow switch should be checked for correct compressor shutdown operation every 1000 hours as part of a scheduled maintenance and service program.

29.1.4. Shell and Tube Heat Exchanger Sections

These provide the heat exchange between the compressing natural gas and the coolant.

29.1.5. Plate Heat Exchanger

The plate heat exchanger provides heat exchange between the open and closed loops. The plate heat exchanger might require cleaning if the differential pressure between the water inlet and outlet exceeds supplier specification.

29.1.6. Cooling Tower

The cooling tower is used to drop the open-circuit temperature to near-ambient temperature. To achieve this, the tower must have water filled to a level specified by the manufacturer. Further, rotation of water sprinklers must be checked every two weeks and scale and dirt deposits must be periodically cleaned to ensure proper operation of the cooling tower and plate heat exchanger systems.

29.1.7. Cooling Tower Pump

The tower pump provides water flow to the open circuit.

29.1.8. Cooling Tower Fan

The fan blows air away from the cooling tower.



29.2. AIR-COOLED SYSTEMS

In air-cooled systems, hot gas from each stage enters a finned-tube, multi-pass heat exchanger segment that uses air provided by high-capacity fans to cool down the gas before entering the next stage or being delivered to the storage system.

29.3. MAINTENANCE AND INSPECTION OF HEAT EXCHANGER SEGMENTS

29.3.1. Fin Cleaning (Air Gas Cooler Units Only)

Fins should be kept free of dirt and lint, which can be removed by directing compressed air perpendicular to the tubes in a direction opposite to the normal air flow.



CAUTION:

DO NOT USE STEAM OR CHEMICALS TO CLEAR THE FINS.

29.3.2. Shell Cleaning (Water Gas Cooler Units Only)

Shell and tube, water-cooling heat exchangers should be flushed with fresh water and provided with a new water/glycol mixture annually.

29.3.3. Inspection

Regular inspection and maintenance of key components will ensure that problems with the operation of a heat exchanger will not arise. Such inspections should be performed every six months.

29.3.3.1. Air Gas Cooler

- Tubes should be inspected for external corrosion and erosion. The extent of wear on the tubes will depend on the severity of service and on the atmospheric conditions on site. Tube wall thickness can be checked externally using an ultrasonic thickness gauge.
- Fans should be checked for wear such as pitting, cracks and corrosion on all surfaces.
- Fan shaft alignment and mounting bolts should be checked.
- A general inspection of the structure should be performed to check for corrosion, damaged members and sheeting and for loose bolting.
- Headers should be inspected for corrosion.

29.3.3.2. Water Gas Cooler

- Tube fittings and flanges should be leak tested.

30. ELECTRIC DRIVE MOTOR LUBRICATION

It is required that the compressor main drive motor have its bearings lubricated as part of a scheduled maintenance and service program.

Lubrication intervals will vary according to the running conditions that the motor is subject to. The ideal running conditions would be described as clean environment (no dust), ambient temperature less than 40 C and maximum of 8 running hours per day. If the existing running conditions are more severe than those described, the lubrication frequency should be increased.

Different motor manufactures have different lubrication recommendations. The greasing intervals for the most commonly used motors are given below. Please contact the factory if your motor is not listed.

30.1. WEG DRIVE MOTOR LUBRICATION

30.1.1. Obtaining Identifying Information

To identify the greasing intervals for WEG motor, the following information is required

- Frame Size
- Bearings type
- Bearing Temperature

The frame size and bearing types can be obtained from the nameplate of the motor as shown in **Error! Reference source not found.** below.

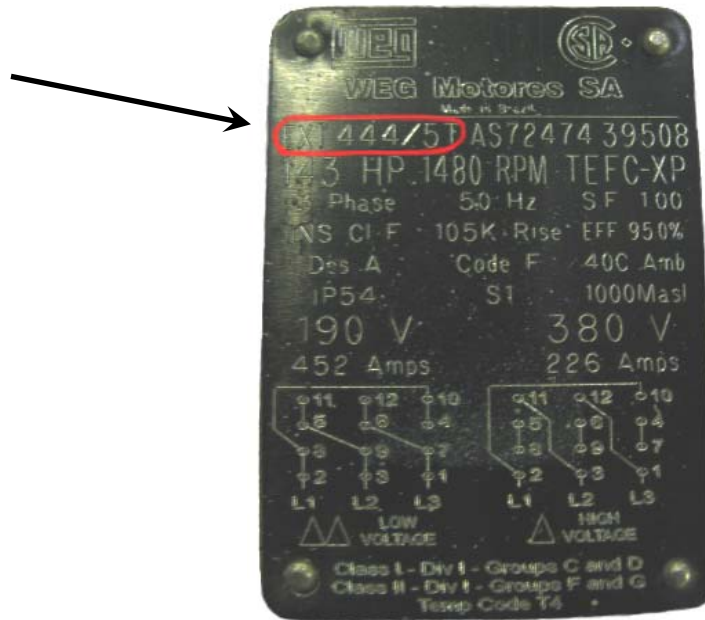


Figure 14: Weg Motor Nameplate

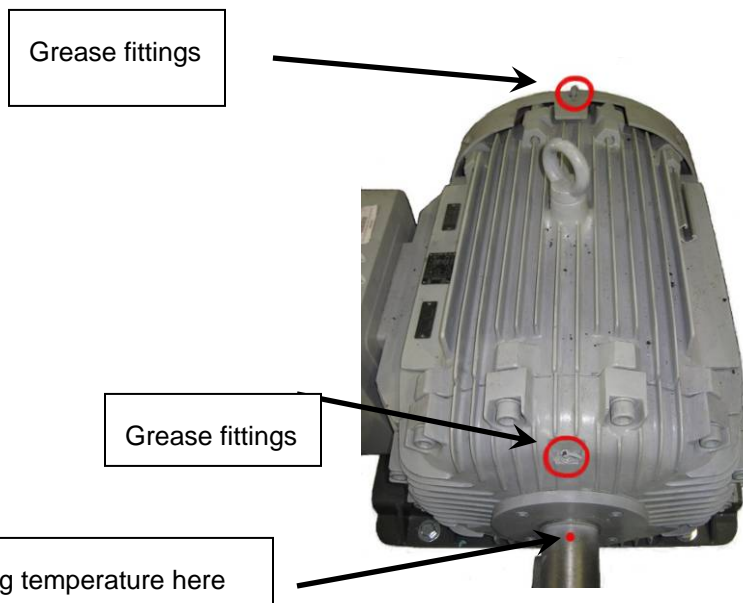


Figure 15: WEG Motor

The bearing temperature can be obtained using an infrared heat measuring device at the motor shaft nearest the bearing, at the location shown in **Error! Reference source not found.** above.

Running conditions severity:

Typical bearing running temperature is 85 °C (185° F).



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For every 15° C above this value, lubrication intervals MUST be reduced by half. For example if the interval tables show 1000 hrs and the bearing temperature is 100° C, the lubrication interval should be every decreased to 500 hrs.

Lubrication Instructions:

Inject about half the estimated amount of grease and run the motor at full speed for approximately a minute; then switch off the motor and inject the remaining quantity.

Lubrication quantities and intervals in hours may be obtained from the following table:

Table 3: Lubrication Intervals For Frames 404, 405, 444, 445, 447, 449, 504 @ 1500 RPM

Bearing	Frame	Grease Quantity		Lubrication Interval (Hours)
		(Strokes)*	(grams)	85 °C
Ball Bearing (Rear)	All	20 - 25	27	11600
Roller Bearing (Front)	404 & 405	27 - 30	34	10400
Roller Bearing (Front)	444, 445, 447, 449, 504	36 - 40	45	9000

Table 4: Lubrication Intervals For Frames 404, 405, 444, 445, 447, 449, 504, 505 @ 1800RPM

Bearing	Frame	Grease Quantity		Lubrication Interval (Hours)
		(Strokes)*	(grams)	85 °C
Ball Bearing (Rear)	All	20 - 25	27	9700
Roller Bearing (Front)	404 & 405	27 - 30	34	8500
Roller Bearing (Front)	444, 445, 447, 449, 504	36 - 40	45	7000

30.2. BALDOR MOTOR LUBRICATION

30.3. DRIVE MOTOR SERVICE CONDITIONS

The motor lubrication intervals given in the following section are for clean work areas at no more than 40°C and an expected motor running time of 8 hours per day.

The following table shows the severity of the motor operating conditions:



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Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40°C	Clean, Little Corrosion
Severe	16+	50°C	Moderate Dirt, Corrosion
Extreme	16+	>50°C	Severe Dirt, Abrasive Dust, Corrosion, Heavy Shock or Vibration

30.3.1. Obtaining Identifying Information

To identify the greasing intervals for a Baldor motor, the following information is required

- Frame Size
- Bearing type

The frame size and bearing type can be obtained from the nameplate in the location shown in **Error! Reference source not found.** below.

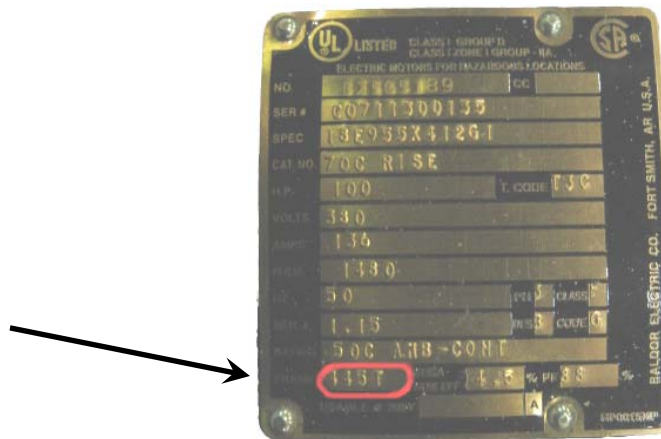


Figure 16: Baldor Motor Nameplate

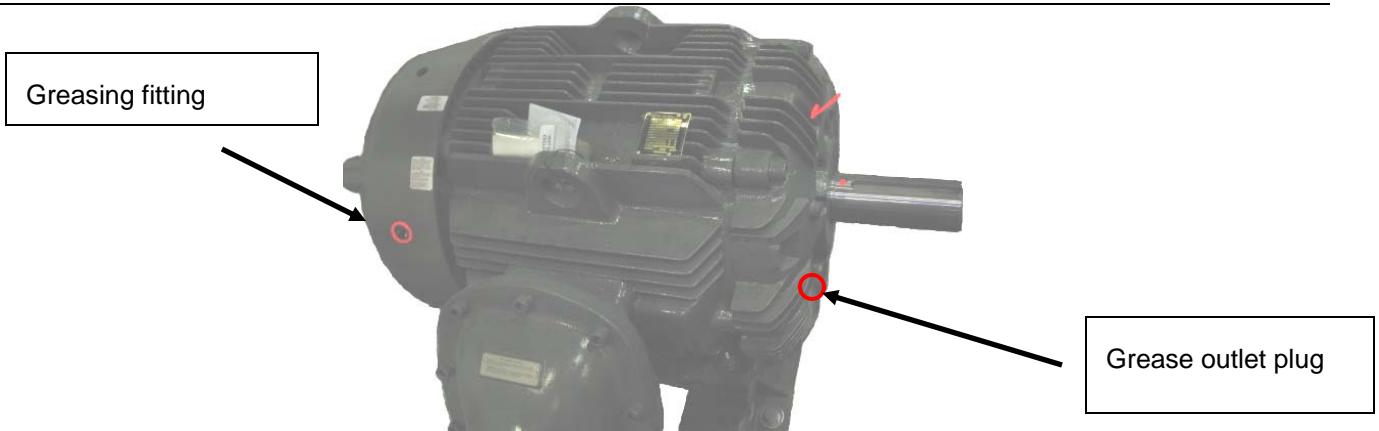


Figure 17: Baldor Motor

Lubrication quantities and intervals in hours may be obtained from the following tables:

Table 5: Baldor NEMA Frames 404T, 405T Lubrication Intervals 1500/1800RPM

Bearing	Grease Quantity		Lubrication Intervals (Hours)		
	(Strokes)*	(g)	Running Conditions		
			Standard	Severe	Extreme
6316 ³	26 - 28	33	3500	1750	350
NU319	48 - 50	60	3500	1750	350

Table 6: Baldor NEMA Frames 445T, 447T, 449T Lubrication Intervals 1500/1800RPM

Bearing	Grease Quantity		Lubrication Intervals (Hours)		
	(Strokes)*	(g)	Running Conditions		
			Standard	Severe	Extreme
6319 ³	48 - 50	60	3500	1750	350
NU319	48 - 50	60	3500	1750	350

NUMBER OF STROKES OF A STANDARD GREASE GUN THAT IS FULL OF GREASE WITH NO AIR BUBBLES

³ If bearings are not listed on the nameplate, use this bearing for both ends



30.4. LUBRICATION INSTRUCTIONS

1. Clean grease fittings.
2. Remove grease outlet plug
3. Apply the total quantity of grease.
4. Run the motor for 15 minutes with grease plug removed. This allows excess grease to purge
5. Re-install grease outlet plug.

30.4.1. Recommended Lubricants for both Baldor & WEG motors

Lubricants may be chosen from the following list:

- Polyrex EM
- Texaco Polystar
- Rykon Premium #2
- Pennzoil Pen 2 Lube
- Chevron SRI

31. TENSIONING

Drive belts should be inspected for wear and tension every 2 weeks as part of a scheduled maintenance and service program. It is important that belt tension be correctly adjusted.

31.1. OBTAINING DRIVE BELT TENSION USING THE FREQUENCY TOOL

Using the drive belt tensioning tool, the drive belt tension may be obtained as follows:

1. Activate the measuring tool.
2. Strike or strum the belt lightly at the mid-point between sheaves (Figure 18).
3. Read the current drive belt tension from the measuring tool and compare to the belt tension given on the nameplate.
4. Tension the belts as required.



Figure 18: Example Orientation of Frequency-based Belt Tension Tester

Tension Requirements:

- If the current tension frequency is lower than the nameplate value, the drive belt will need to be tightened.
- If the current tension frequency is higher than the nameplate value, the drive belt will need to be loosened.



31.2. OBTAINING DRIVE BELT TENSION USING BELT DEFLECTION

The following chart provides belt tension for different compressor driver configurations. To use the chart, you must obtain data regarding:

- Sheave Diameter, (in),
- and Belt Length, (in).

The deflection chart may then be read to obtain an acceptable belt deflection. This belt deflection is for an applied measurement force of 75 N (7.64 kg or 16.8 lbs).

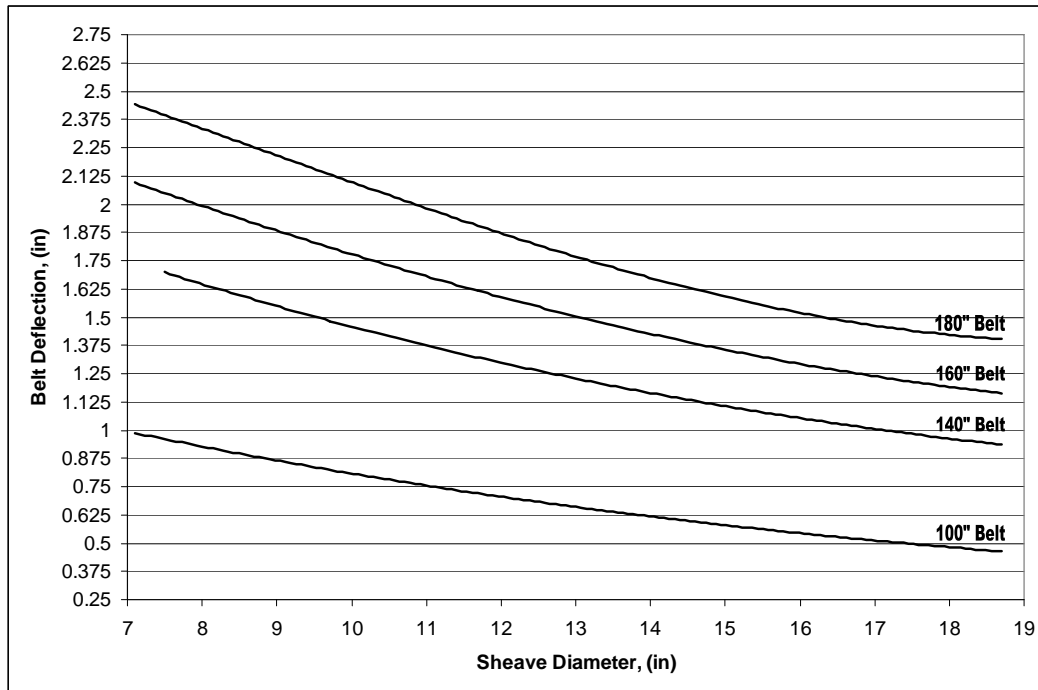


Figure 19: Tensioned Belt Deflection vs. Sheave Diameter

This belt tensioning chart applies to compressors having a main driver power of 100hp or greater. For details on lower power compressors, contact the factory.

31.3. TENSIONING THE BELTS

Belts may be tensioned using bolts located on the motor slide base or gas-drive engine slide base. For electric motors, see Figure 20. For gas engines, see Figure 21. Bolts should be turned evenly to uniformly move the drive unit.

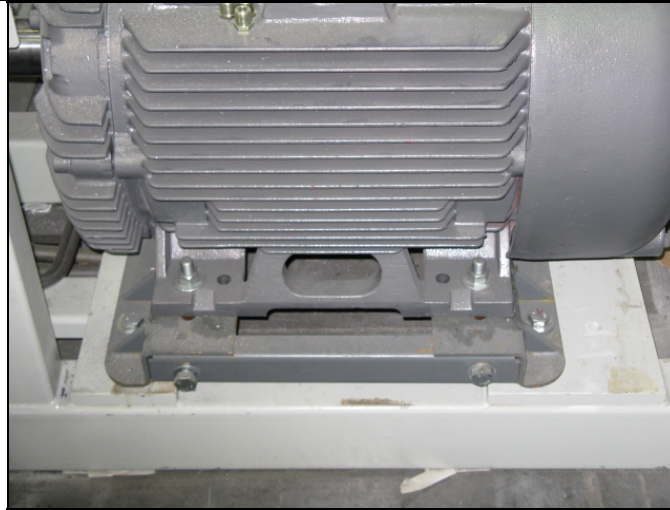


Figure 20: Motor Slide Base



Figure 21: Engine Slide Base



CAUTION: SLIDE BASE BOLTS SHOULD BE TURNED EVENLY. UNEVEN TURNING CAN DAMAGE THE BOLTS AND NEGATIVELY AFFECT SHEAVE ALIGNMENT.

NOTES:

1. When removing or installing belts, do not pry them over pulley grooves. Loosen the motor anchor nuts and use the motor base adjustment bolts to move the motor towards the compressor.
2. Tension new belts at the maximum deflection force recommended. Check the tension at least two times during the first day's operation as there normally will be a rapid decrease in belt tension until belts have run in. Check the tension periodically after the first day's operation and keep tension in recommended area.
3. For drives with more than one belt, belts must be replaced as a matched set for equal load distribution.
4. Do not install new sets of belts in drives where the sheaves have worn grooves. Such sheaves should be replaced with new sheaves to insure a proper fit of the belts in the grooves, thus eliminating the possibility of premature belt failure.



5. Store spare belts in a cool, dark, dry place.

32. GAS DRIVE ENGINE MAINTENANCE

For details on operation and maintenance of gas engines, refer to manufacturer's literature supplied with gas driven compressors.

33. COMPRESSOR LUBRICATION

Lubrication of the compressor crankshaft bearings, connecting rod bearings and crosshead guides is achieved using a single oil pump, which is integral with the crankcase. It is important to understand the operation of the oil pump and its relation to the lubrication system of the compressor.



CAUTION: THE OIL PUMP USED INSIDE AN ALPHA3 COMPRESSOR BLOCK IS UNIDIRECTIONAL. THE COMPRESSOR MUST ROTATE IN AN ANTI-CLOCKWISE DIRECTION FACING THE FLYWHEEL. ANY REVERSED ROTATION WILL RESULT IN A LACK OF LUBRICATION OIL AND DAMAGE TO THE BLOCK.

33.1. LUBRICATION SYSTEM

Oil is stored in the crankcase sump, from which a gear type oil pump draws it. The oil pump is located inside the compressor crankcase. A pump driver gear is on the crankshaft with the gear pump driven gear on the end of the pump shaft. Normal operating oil pressure is 40-60 psig.

Oil is drawn into the oil pump from the crankcase sump and then passes through the oil filter. The oil travels to the oil filter through an oil passage drilled in the crankcase wall. The filter manifold block houses a nonadjustable pressure relief valve. This relief valve is upstream of the filter and protects the system from over pressurizing in case of filter clogging. Oil is taken back to the crankshaft out of the filter for the lubrication of the crankshaft and connecting rod bearings.

On IMW50 series compressors, two types of crosshead lubrication may be used. For double-acting and step cylinders, internal lubrication is provided wherein the crosshead is lubricated through an oil galley that passes through the connecting rod wrist pin. For single-acting cylinders, oil is carried through stainless steel tubes from an oil manifold to lubrication ports on the crosshead guides.

On Alpha3 series compressors, the secondary line runs to a labyrinth seal on the compressor after being cooled in the oil cooler. From the labyrinth seal, oil is distributed to each of the crosshead guides and through the crankshaft and connecting rods.

Some compressor units may be equipped with an oil cooler. Oil is piped to the oil cooler once it discharges from the filter. From the oil cooler the oil then enters the manifold block for crosshead guide lubrication distribution.

33.2. LUBRICATION OIL

IMW recommended lubricants are listed in the service appendix of this manual. Be advised, use of lubricants other than specified by the document voids warranty.

33.3. OIL AND FILTER CHANGE

It is recommended that the crankcase oil and filter be changed every 1000 hours, in the cases of infrequent use, at least every 6 months. If the compressor has been in storage for an extended period of time before commissioning, it is recommended the oil be changed before start-up and the crankcase be inspected for moisture due to condensation. If moisture is present, the crankcase must be cleaned out with a clean lint-free cloth before adding new oil.

To drain crankcase oil, place a bucket below the crankcase oil drain pipe and open the ball valve. If possible, drain oil immediately after compressor has run as the oil will run more freely when warm. When the oil has finished draining, close the ball valve. Before refilling the crankcase with oil, replace the oil filter. Spin off the filter and replace with a new one.

Once the new filter is installed refill the compressor crankcase with the recommended oil, via the oil filler spout. Oil should be added slowly to avoid building up crankcase back pressure which could force oil back out of the



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filler spout. Crankcase oil level should be up to the full mark on the sight gauge on IMW50 series compressors, and at the “high level” oil sight glass on Alpha3 series compressors.



CAUTION:

DO NOT OVERFILL!

Compressor crankcase oil level should be checked on a daily basis and adjusted if necessary.

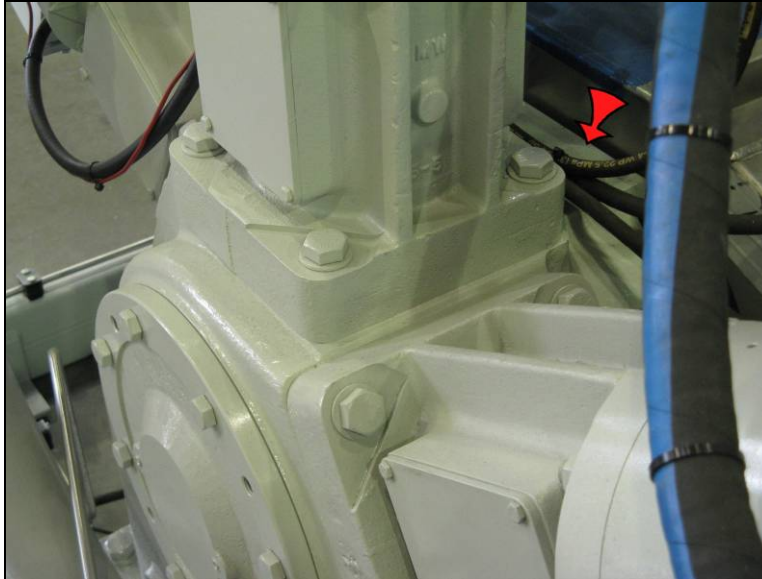


Figure 22: IMW50 Oil Fill Location

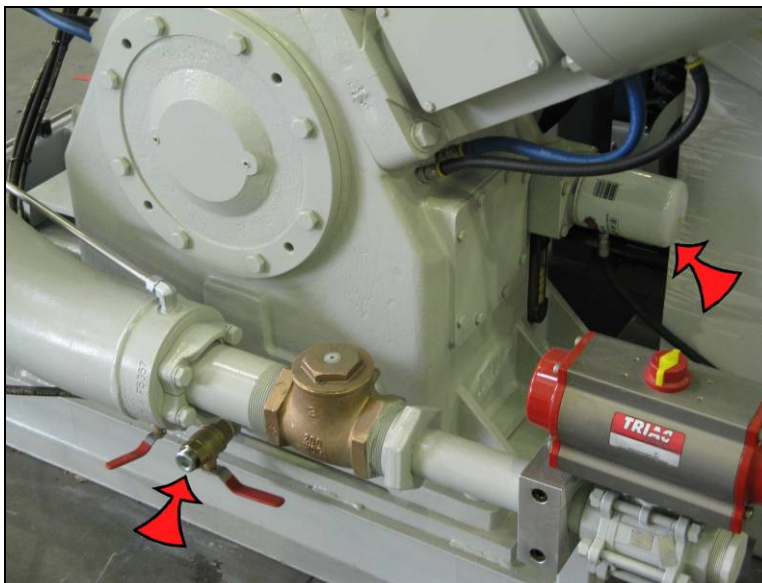


Figure 23: IMW50 Oil Drain Valve and Filter Location

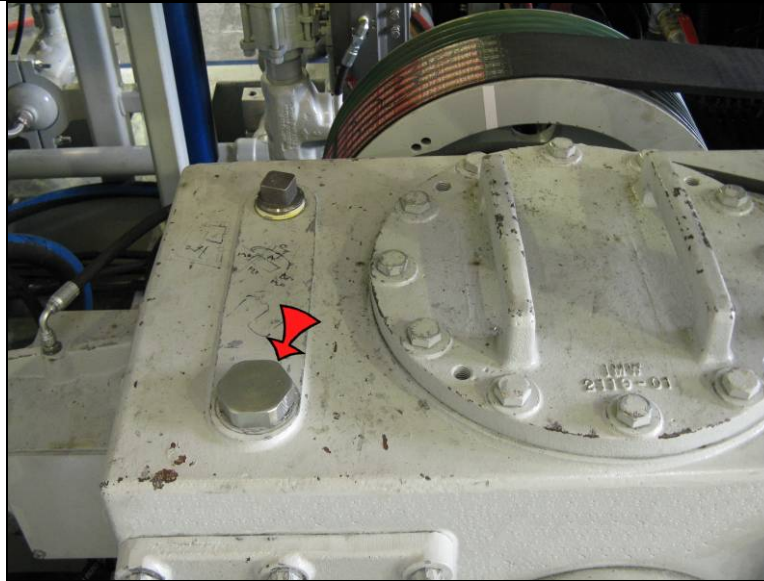


Figure 24: IMW Alpha3 Oil Fill Location

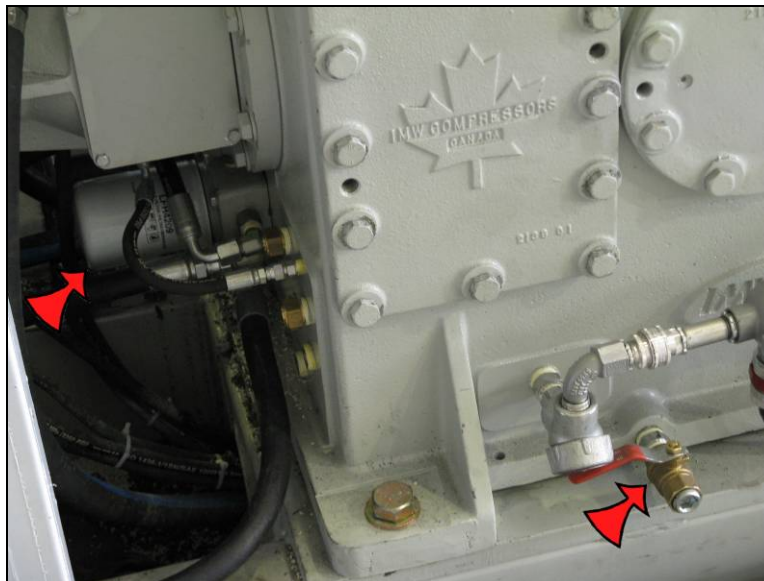


Figure 25: IMW Alpha3 Oil Drain Valve and Filter Location

34. COMPRESSOR VALVES

For the efficient operation of the compressor it is essential that the compressor valves be operating properly. Improper valve operation will likely result in inter-stage pressure and temperature readings that are outside of the range of design; this could result in compressor shutdown due to excessive stage discharge temperatures.



Figure 26: Compressor Valve

It is recommended that the compressor suction and discharge valves be checked, cleaned and tested every 2000 hours as part of a routine service and maintenance schedule.

35. BOLT TORQUE SPECIFICATIONS

See appendices for details on bolt torque specifications.

36. COMPRESSOR STATION MAINTENANCE SCHEDULE

It is extremely important to organize a scheduled maintenance and service program for the compressor station to commence immediately after the equipment has been commissioned. The maintenance and service of a compressor station should be carried out by trained technicians. They should possess a broad range of practical knowledge from mechanics to electronics and be experienced in the maintenance of industrial equipment. Service personnel should also be given specific training pertaining to the compressor station and be fully aware of all dangers, hazards, and safety procedures.

In addition, it is recommended that a “walk around” cursory inspection of the compressor station be made on a daily basis by the operator. This inspection should include the following:

- Verify that compressors are starting and stopping correctly.
- Check compressor oil level.
- Check that the system is operating correctly.
- Visual inspection for anything unusual.

Compressor station service and maintenance should be systematic, thorough and well documented with a maintenance and service log book. A maintenance schedule recommended by IMW may be found in the service appendix.



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IMW COMPRESSOR MANUAL SERVICE DOCUMENT LIST

The service appendix of the IMW compressor manual consists of drawings and other documents related to ongoing service.

As with the Main Document List, this document lists the complete set of items that comprise the IMW compressor manual service appendix.

Description	Document Number	Revision	Pages
WARRANTY STATEMENT	WI-AD-2007-001	0	1
COMPRESSOR MAINTENANCE SCHEDULE	WI-SV-2009-001	0	2
RECOMMENDED LUBRICANTS IMW ALPHA3 & IMW50 COMPRESSORS	WI-SV-2009-003	0	1
IMW50 SERIES COMPRESSOR TORQUE SPECIFICATIONS	WI-MF-2005-002	2	2
RGV – RING GASKET VALVE SCHEDULE	N/A	0	1
SHORTBLOCK ASSEMBLY – IMW50 CONNECTING ROD ASSEMBLY	202618-04	D	2
SHORTBLOCK ASSEMBLY – OIL RELIEF VALVE ASSEMBLY	2639-00	G	2
SHORTBLOCK ASSEMBLY – IMW50 OIL PUMP ASSEMBLY	2640-00	C	2
SHORTBLOCK ASSEMBLY – IMW50 CRANKSHAFT ASSEMBLY	40008-XX	B	2
SHORTBLOCK ASSEMBLY – IMW50 CRANKCASE ASSEMBLY	2643-00	F	2
IMW50 1.375 1.500 1.625 & 1.750 SAHE SEAL CARRIER ASSEMBLY	2981-00	C	2
IMW50 1.750" BORE SAHE AC CYLINDER ASSEMBLY	2605-00	B	2
IMW50 1.375 1.500 1.625 & 1.750 SAHE SEAL CARRIER ASSEMBLY	2981-00	C	2
IMW50 1.375" BORE SAHE AC CYLINDER ASSEMBLY	2753-00	N/A	2
CROSSHEAD GUIDE & CROSSHEAD GUIDE ASSEMBLY	1313-00	G	2



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WARRANTY STATEMENT

IMW INDUSTRIES LTD. warrants all equipment sold hereunder (except accessory and auxiliary items manufactured by others, which are sold only under such warranty as the manufacturer provides) to be free from defects in material and workmanship.

This warranty is in effect for eighteen (18) months from the date of shipment of the equipment, or twelve (12) months from the equipment start-up date, or for 4000 hours of operation, whichever occurs first. Should such equipment or part thereof or material used therein prove defective, IMW INDUSTRIES LTD., at its option, will: A) replace the defective part, B) authorise the part to be returned to its plant for repair, or C) authorise the part to be repaired at an alternative location approved by IMW.

Defective parts will be repaired or replaced without charge but removal and installation of other parts, including any additional parts furnished, is to be made at the customer's expense. No charges will be accepted for repairs or alterations done by the customer unless previously authorised in writing by IMW INDUSTRIES LTD.

The foregoing warranty does not apply to surface finishes where the customer specifies the brand of finish, except so far as to warrant that IMW INDUSTRIES LTD. will follow the manufacturer's recommendations in the application of said finish. All such finishes will be warranted only by the warranties offered by the paint manufacturer.

IMW INDUSTRIES LTD. warrants that it is the lawful owner of all materials and equipment sold hereunder and that said material and equipment is free from all claims and encumbrances.

In no event shall IMW INDUSTRIES LTD. be liable for the customer's or any third party's lost profits, goodwill, manufacturing costs, or other special or consequential damages arising from any warranty claim.

If the equipment is designed by the customer, or specifications are submitted by the customer, no responsibility of any kind is assumed by IMW INDUSTRIES LTD. excepting a failure to meet such specifications or a defect in material used and workmanship employed as hereinabove specified.

It is the customer's responsibility to ensure that the equipment is used in the correct application, within the manufacturer's specified parameters for airflow, inlet gas pressure and temperature, ambient air temperature, gas purity (free of contaminants, dirt and/or water) and electrical supply (protected from over and/or under voltage, line noise and/or spikes)

The foregoing warranty shall be considered null and void if: (1) the equipment is used for a purpose for which it was not designed (2) the equipment is used under conditions for which it was not designed (3) the equipment comes in contact with gas and/or electrical supply conditions for which it is not designed (4) repairs are done by unauthorized personnel (5) oils and/or lubricants are used that are not approved by the manufacturer (6) the initial equipment start-up is performed by unauthorized personnel (7) any of the equipment is moved to a different location without approval from the manufacturer (8) the equipment is not maintained in accordance with the recommended maintenance schedule as outlined in the manufacturer's documentation (9) Original Equipment Manufacturer (OEM) parts are not used.

The foregoing warranty does not apply to: (1) gas and/or oil filter cleaning/replacement (2) oil changes (3) parts coming in contact with corrosive chemicals (4) parts normally subject to wear and tear, such as, but not limited to: compressor valves, piston rings, rod packings, dispenser hose nozzles, O-rings and valves (5) damage from acts of God, vandalism, fire, accidents and/or vehicle collisions (6) damage from the negligent operation of the equipment (7) damage caused by unauthorized personnel performing start-up, running and/or maintenance operations (8) damage from continuing to operate the equipment in a fault or alarm condition without written approval from the manufacturer.

The foregoing warranty is exclusive and in lieu of all other warranties and/or guarantees whether written, oral, or implied (including any warranty of merchantability or fitness of purpose). All warranties which exceed the aforementioned obligations are hereby disclaimed by IMW INDUSTRIES LTD. and excluded from this warranty. No other person is authorised to give any other warranty or to assume any other liability on the behalf of IMW INDUSTRIES LTD.

**Brad Miller - President
IMW INDUSTRIES LTD.**



COMPRESSOR MAINTENANCE SCHEDULE

Item	IMW Factory Recommended Maintenance Items	Every 2 weeks	Monthly	500 hours or 6 mos.	1,000 hours	2,000 hours or 1 yr.	Annually	5,000 hours	10,000 hours	20,000 hours	40,000 hours
1	Check the service log sheet. Aftermarket Network Service History/Outstanding items.	•									
2	Check/record compressor inlet pressure.	•									
3	Check/record interstage pressures and temperatures as compressor approaches final discharge pressure set point. Compare with design.	•									
4	Check/record oil pressures and coolant* temperatures.	•									
5	Visually inspect compressor hoses, tubing, piping and valves for leaks and abnormalities.	•									
6	Visually inspect gas panels for leaks and abnormalities.	•									
7	Listen for any abnormal sounds such as banging or hissing, to indicate problem areas.	•									
8	Check priority panel for proper functioning.	•									
9	Check oil levels on compressor and gas drive engine.*	•									
10	Check glycol/water coolant levels* for compressor and gas engine (if applicable).	•									
11	Check coolant pump* and motor.	•									
12	Check all belts for proper tension, alignment and signs of excessive wear.	•									
13	Drain interstage scrubbers and all filters.	•									
14	Drain recovery tank sump and vent header.	•									
15	Visually inspect all pressure relief devices for signs of failure or leakage.		•								
16	Verify ESD control function.		•								
17	Verify storage/cascade excess flow valves.*			•							
18	Check all pressure regulator settings.			•							
19	Verify inlet control valve operation.			•							



COMPRESSOR MAINTENANCE SCHEDULE

Item	IMW Factory Recommended Maintenance Items	Every 2 weeks	Monthly	500 hours or 6 mos.	1,000 hours	2,000 hours or 1 yr.	Annually	5,000 hours	10,000 hours	20,000 hours	40,000 hours
20	Change compressor oil and oil filter, and check for any unusual particles in the waste oil.				•						
21	Change inlet and discharge filter elements, and check filter bowl/element for contents.				•						
22	Check set points of all instrumentation (pressure and temperature switches, oil level switches, flow switch* etc.). Compare with design.				•						
23	During start-up of compressor, check total time for recovery tank to drain down to inlet pressure. Compare with design.				•						
24	Lubricate main drive motor bearings.					•					
25	Remove and clean compressor valves. Inspect for cracks or breakage. Leak-test with solvent, and disassemble and inspect inside if there are signs of excessive wear or leakage.					•					
26	Perform vibration tests.						•				
27	Flush cooling system* and fill with new water/glycol mixture (50/50).						•				
28	Winter/summer oil check*. Change to suitable weight oil as required.						•				
29	Remove and inspect rod packings, piston rings and compressor valves. Replace if there are signs of excessive wear.							•			
30	Remove and inspect pistons and piston rods. Replace if there are signs of excessive wear.							•			
31	Remove and/or inspect cylinders, cylinder liners, seal carriers and rod packing blocks. Replace if there are signs of excessive wear.								•		
32	Inspect wrist pin bearings/bushings. Replace if there are signs of excessive wear.								•		
33	Replace connecting rod journal bearings.									•	
34	Replace crankshaft end bearings, cones and oil seals.										•

*if applicable



RECOMMENDED LUBRICANTS - IMW ALPHA3 AND IMW50 COMPRESSORS

Cold Climates:

Cold climates include areas where the maximum ambient temperature is less than 30oC. The minimum temperature is not specified, however, if it is below 10oC, an oil heater is required. For cold climates, IMW recommends an ISO 120 or ISO 150 grade of oil. The following grades are acceptable:

- Esso Compressor Oil 122
- Shell Corena P 122
- Chevron AIO 150
- Exxon Teresstic 150
- Mobil DTE Extra Heavy 150

Moderate Climates:

Moderate climates include areas where the maximum ambient temperature is less than 40oC. The minimum temperature is not specified, however, if it is below 10oC, an oil heater is required. For moderate climates, IMW recommends an ISO 150 grade of oil. The following grades are acceptable:


- Chevron AIO 150
- Exxon Teresstic 150
- Mobil DTE Extra Heavy 150

Hot Climates:

Hot climates include areas where the maximum ambient temperature is greater than 40oC. The minimum temperature is not specified, however, if it is below 10oC, an oil heater is required. For hot climates, IMW recommends an ISO 220 grade of oil. The following grades are acceptable:

- Chevron AIO 220
- Esso Compressor Oil 220
- Exxon Teresstic 220
- Mobil DTE BB 220
- Shell Corena P 220
- Mobil DTE AA 320

Any grades of oil, other than the ones listed above, must be approved by IMW Engineering or warranty will be void.

	Document Title IMW50 Series Compressor Torque Specifications			Document # WI-MF-2005-002
Prepared By: Ed Louwerse	Approved By: Martin Loffler, QA Mgr	Revision #: 2	Revision Date: 2008/03/24	Page 1 of 2

I. POLICY

Products manufactured at IMW are manufactured to the highest standard of quality.

II. PURPOSE

To ensure assembly of IMW50 single and double acting compressors are assembled to a standard and to ensure that bolts are tightened to the correct torque.


III. DEFINITION

Not applicable.

IV. RESPONSIBILITY & AUTHORITY

The Lead Engineer is responsible for ensuring that the torque tables are defined and are kept current with changing conditions and designs.

The Production Foreman is responsible for ensuring that the specifications in this Work Instruction are followed and that the requirements defined herein are met for each block assembly.

	Document Title IMW50 Series Compressor Torque Specifications			Document # WI-MF-2005-002
Prepared By: Ed Louwerse	Approved By: Martin Loffler, QA Mgr	Revision #: 2	Revision Date: 2008/03/24	Page 2 of 2

V. PROCEDURE

TABLE T3 – IMW50 SERIES COMPRESSOR TORQUE SPECIFICATIONS

IMW50 Bolt Torque						
Item		Bolt Size	Minimum Bolt Grade	Torque		Conditions
				N-m	ft-lbs	
Double Acting Cylinder Head Bolt		1/2 UNC	5	102	75	Non-lubricated
Single Acting Cylinder Head Bolt		5/8 UNC	5	203	150	Non-lubricated
Single Acting Cylinder Head Bolt		3/4 UNC	5	271	200	Lubricated
Crosshead Guide Bolt to Crankcase		3/4 UNC	5	271	200	Lubricated
Cylinder Stud		5/8 UNC	5	183	135	Non-lubricated
Cylinder Bolt		3/4 UNC	5	271	200	Lubricated
Manifold Bolt		1/2 UNC	5	108	80	Non-lubricated
Valve Holder Bolt		3/8 UNC	5	34	25	Non-lubricated
Single Acting Valve Holder Bolt		5/8 UNC	5	217	160	Non-lubricated
Connecting Rod Screw		M14-1.5	-	136	100	Fresh Blue Loctite 242
Con-rod Small End Bolt for Wrist Pin		1/2-20 UNF	-	108	80	Fresh Blue Loctite 242
Counter-weight SHCS		5/8-18UNF	-	136	100	Fresh Blue Loctite 242
Crosshead / Piston Rod Taper Nut	5.5" extension & 18" handle wrench to reach 300 ft-lbs (407 N-m)	1 1/6-16 UN	-	312	230	Non-lubricated
	5.5" extension & 22" handle wrench to reach 300 ft-lbs (407 N-m)			325	240	
Piston Nut for Aluminum Piston		3/4-16 UNF	-	136	100	Fresh Blue Loctite 242
Piston Nut for Steel Piston		3/4-16 UNF	-	203	150	Fresh Blue Loctite 242
Piston Nut for Aluminum Piston		5/8-18 UNF	-	136	100	Fresh Blue Loctite 242
Piston Nut for Steel Piston		5/8-18 UNF	-	136	100	Fresh Blue Loctite 242
All SA Retaining Nut Piston	1.5" offset & 22" handle wrench to reach 100 ft-lbs (136 N-m)	5/8-18 UNF	-	126	93	Fresh Blue Loctite 242
	Standard	5/8-18 UNF	-	136	100	Fresh Blue Loctite 242
8" DA Piston Nut 2961-00		1 3/16-16 UN	-	271	200	Non-lubricated
Flywheel Nut		2-8 UN	-	949 approx.	700 approx.	Non-lubricated
Compressor Mounting Bolt on Skid		7/8 UNC	-	407 approx.	300 approx.	Non-lubricated

1 ft-lb = 1.36 N-m

VI. FILING

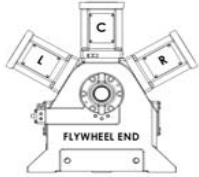
Not applicable.

VII. RELATED DOCUMENTS

Not applicable

Italics indicate changes from previous revision.

RING-GASKET-VALVE SCHEDULE

Arrangement			Cylinder / Piston					Piston Rings			Packing Rings				Valves			Gaskets		
Throw	Stage		Size	Type	CE End Gap	HE End Gap	Piston Cut-off	Sealing	Rider		Pressure Breaker	Sealing	Vent	Wiper	Type	Keeper	Valve	Cylinder	Qty per Valve	Height
R	1		1.750	SAHE	-	0.040	-	321131 6	321132 1		323675 1	305291 4	321124 1	330817 1	Concentric	-	324338 1	201095	1	0.040
L	1		1.750	SAHE	-	0.040	-	321131 6	321132 1		323675 1	305291 4	321124 1	330817 1	Concentric	-	324338 1	201095	1	0.040
C	2		1.375	SAHE	-	0.040	-	322040 6	322041 1		323675 1	305291 4	321124 1	330817 1	Concentric	-	324338 1	201095	1	0.040

NOTES:

DA: DOUBLE ACTING

SA: SINGLE ACTING

SACE: SINGLE ACTING CRANK END

SAHE: SINGLE ACTING HEAD END

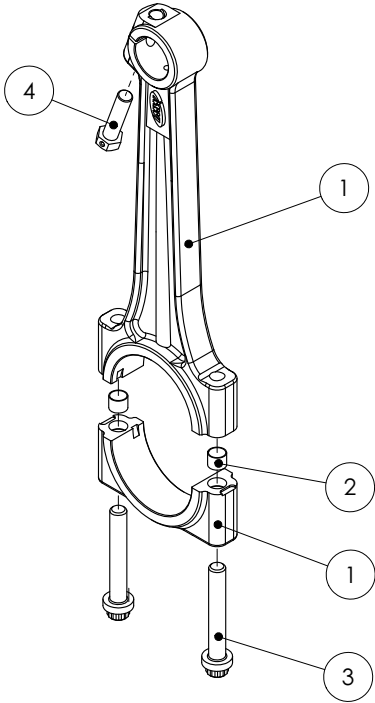
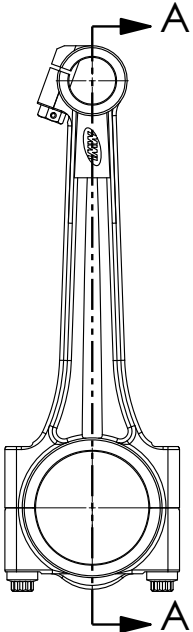
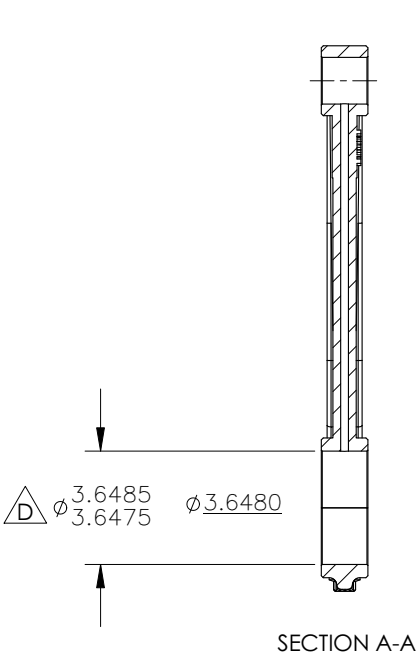
CBA Number: 220044
Country: Canada
Configuration Number: IMW50-2X17H/13H-AC-1
Signature: BJN



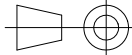

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REVISION HISTORY			
REV.	DATE	BY	REFERENCE
D	2005-08-17	DVL	OPENED UP MAIN BORE



ITEM NO.	QTY.	DESCRIPTION	SIZE	SPECIFICATION	PART NUMBER	WEIGHT
1	1	CONNECTING ROD	IMW50	DUCTILE IRON 100-70-03	202618-02	9.6
2	2	DOWEL RING	n/a	CUMMINS# 3027106	306516	0.007
3	2	12 POINT BOLT	M14 X 1.5 X 90 LG	CUMMINS# 306517	306517	0.3
4	1	PINCH BOLT	0.5 - 20UNF X 2.000	CS, GR.8	202980-00	0.16

				IMW Industries Ltd. Chilliwack, BC, Canada	
TITLE IMW 50 CONNECTING ROD ASSEMBLY					
REF. STANDARD		SIZE B	FILE. NO. 030-02101-2618-04		REV D
DR. DVL 2004/05/31			DWG. NO. MRP ID 202618-04		
CK.					
AP.		SCALE 1:1	WEIGHT 10.4		SHEET 1 / 1



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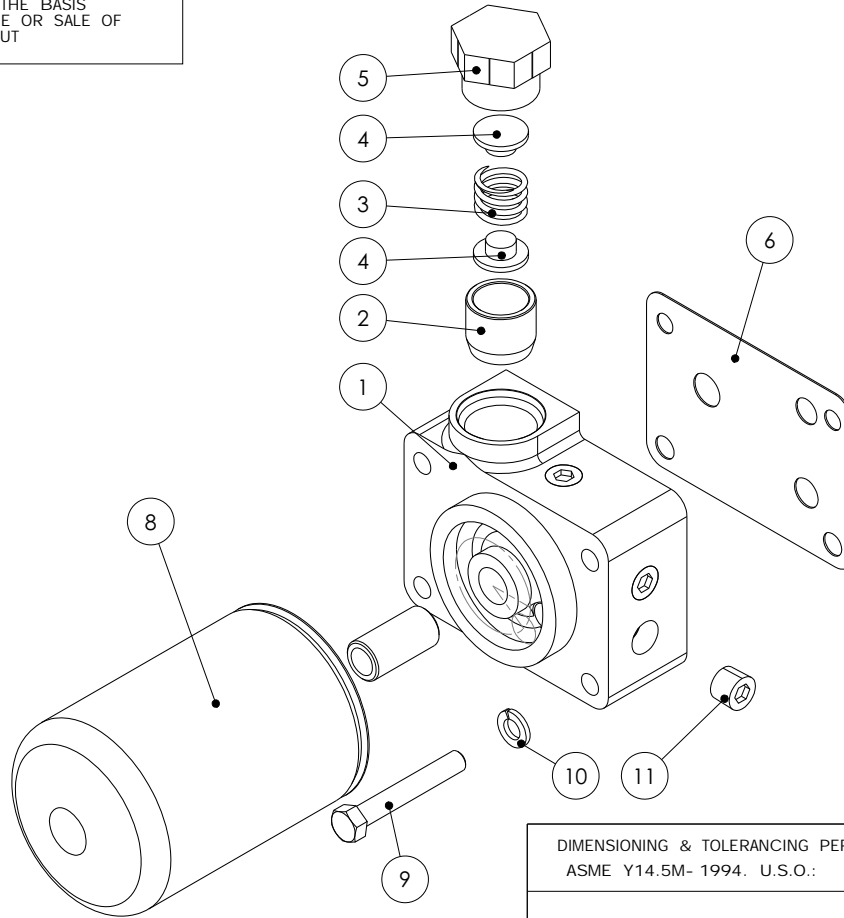
Parts and Components of 202642-00(CONNECTING ROD ASSEMBLY
IMW50---SUB_ID: 0)
WorkOrder/Eng. Master: 206058

<i>Ref</i>	<i>Part ID</i>	<i>Description</i>	<i>QTY</i> <i>per Asm</i>	<i>QTY</i> <i>per W/O</i>	<i>Sub</i> <i>W/O</i>
01-4	.202618-04	IMW 50 CONNECTING ROD ASSEMBLED	1.00	3.00	
B	.306485	BEARING SHELL 3.644 X 3.5 X 1.4	2.00	6.00	
----- End of List -----					



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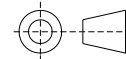


REVISION HISTORY

REV.	DATE	BY	CK.	DCR#	REFERENCE
G	2009/09/11	DY	BVK	N/A	ADDED PART 303825 AND UPDATED IN SOLIDWORKS

ITEM NO.	QTY	PART NUMBER	DESCRIPTION	UOM
1	1	203808	OIL RELIEF MANIFOLD	EA
2	1	202631-01	PISTON, OIL RELIEF VALVE	EA
3	1	309910	SPRING # C57	EA
4	2	202968-00	SPACER IMW50 OIL RELIEF VALVE	EA
5	1	202632	HEX PLUG	EA
6	1	202653	IMW50 CRANKCASE OIL RELIEF VALVE GASKET	EA
7	1	2020656	IMW50 CRANKCASE OIL FILTER ADAPTOR	EA
8	1	310983	FILTER OIL L1 HP1	EA
9	4	301728	BOLT HH CS GR.5 0.375-16UNC X 2.500 ZN	EA
10	4	314794	WASHER LOCK 0.375 ZN	EA
11	3	303825	PLUG HEX HOLLOW 0.375	EA

DIMENSIONING & TOLERANCING PER
ASME Y14.5M- 1994. U.S.O.:



IMW Industries Ltd.
Chilliwack, BC, Canada

TITLE

OIL RELIEF VALVE ASSEMBLY

UNITS	INCHES	X/X	±1/16
FINISH	64 MICRO IN.	.X	±.1
INNER RADI	.03 MAX.	.XX	±.01
OUTER	.03 MIN.	.XXX	±.005
EDGE	X 45°	ANGLES	±.5

REF. STANDARD	SIZE	FILE. NO.
DR. DY 2009/09/11	B	202639-00
CK. BVK 2009/09/11		DWG. NO. 202639-00
AP.		MRP ID

REV	G
SCALE	1:2
WEIGHT	17.9 LBS
SHEET	1 / 1



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**Parts and Components of 202639-00(OIL RELIEF VALVE ASSEMBLY--
-SUB_ID: 0)**

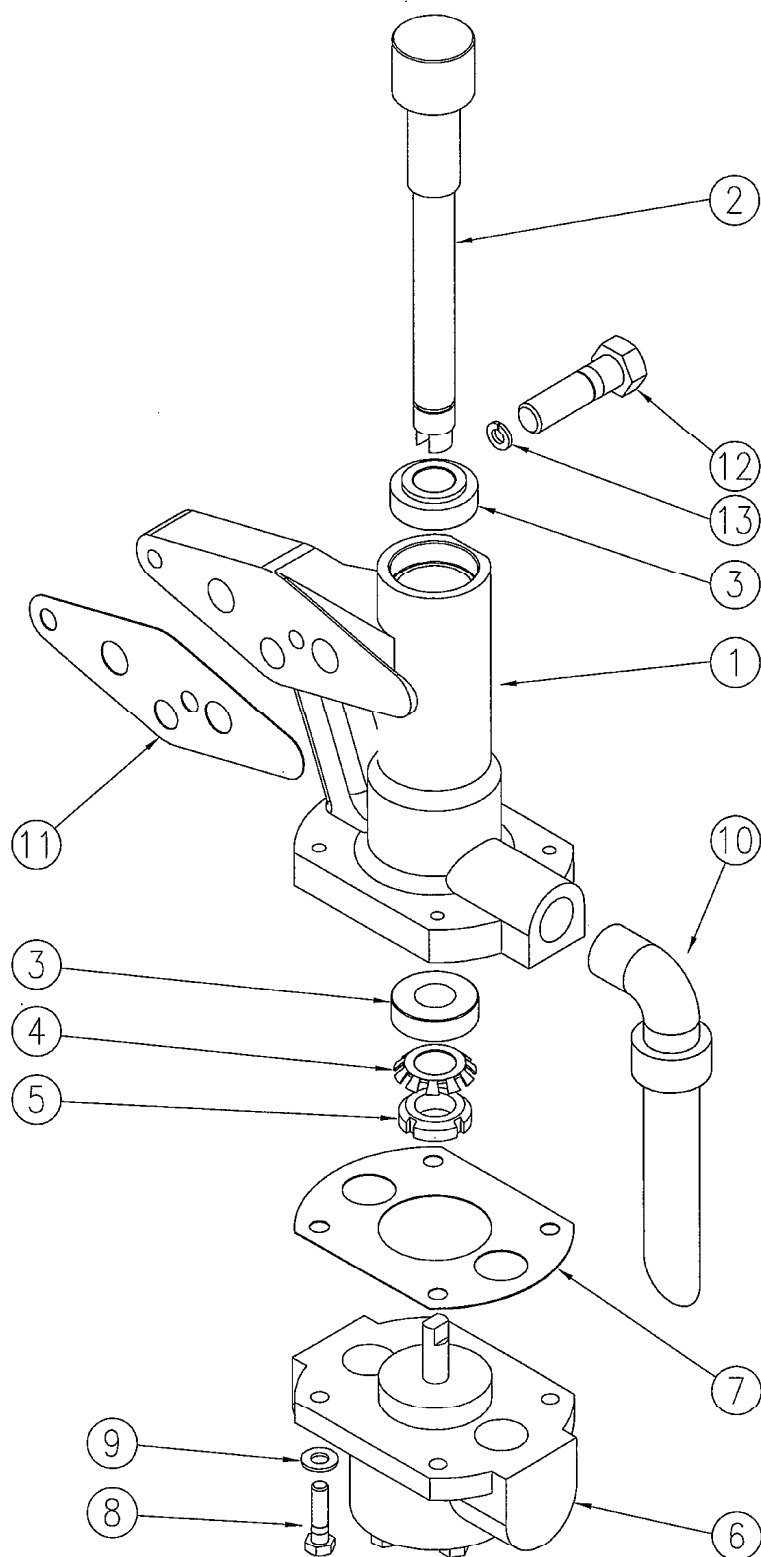
WorkOrder/Eng. Master: 206058

<i>Ref</i>	<i>Part ID</i>	<i>Description</i>	<i>QTY per Asm</i>	<i>QTY per W/O</i>	<i>Sub W/O</i>
01	.203808	OIL RELIEF MANIFOLD	1.00	1.00	
02	.202631-01	PISTON OIL RELIEF MANIFOLD	1.00	1.00	
03	.309910	SPRING # C57	1.00	1.00	
04	.202968-00	SPACER IMW50 OIL RELIEF VALVE	2.00	2.00	
05	.202632-01	CAP OIL RELIEF VALVE IMW50	1.00	1.00	
06	.202653-00	IMW50 CRANKCASE OIL RELIEF VALVE	1.00	1.00	
07	.202656-00	IMW50 CRANKCASE OIL FILTER ADAPTOR	1.00	1.00	
09	.301728	BOLT HH CS GR.5 0.375-16UNC X 2.500 ZN	4.00	4.00	
10	.314794	WASHER LOCK 0.375 ZN	4.00	4.00	

----- End of List -----



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IMW50 OIL PUMP ASSEMBLY

DRAWING # 2640-00, BY KH, 2002/01/22

LATEST REVISION C, BY DVL 2004-06-28

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Parts and Components of 202640-00(OIL PUMP ASSEMBLY---SUB_ID: 0)

WorkOrder/Eng. Master: 206058

<i>Ref</i>	<i>Part ID</i>	<i>Description</i>	<i>QTY per Asm</i>	<i>QTY per W/O</i>	<i>Sub W/O</i>
01	.202621-01	IMW50 CRANKCASE OIL PUMP BRACKET	1.00	1.00	
02	.202629-00	IMW50 CRANKCASE OIL PUMP DRIVEGEAR	1.00	1.00	
03	.306614	BEARING TAPER 42M X 20M X 15M	2.00	2.00	
04	.315952	BEARING LOCK WASHER 4	1.00	1.00	
05	.315959	BEARING NUT 4	1.00	1.00	
06	.306210	PUMP OIL 2RFD 6GPM@1800RPM	1.00	1.00	
08	.307261	BOLT HH CS GR.5 0.313-18UNC X 1.250 ZN	4.00	4.00	
09	.302345	WASHER LOCK GR 8 0.313 PLATED	4.00	4.00	
11	.202651-00	IMW50 CRANKCASE OIL PUMP BRACKET	1.00	1.00	
12	.307377	BOLT HH CS GR.5 0.625-11UNC X 2.250 ZN	2.00	2.00	
13	.304523	WASHER LOCK GR 8 0.625 PLATED	2.00	2.00	
14	.316820	ELBOW PIPE STR 90 BLK 0.750NPT	1.00	1.00	
15	.301197	NIPPLE PIPE CS 0.750MNPT X 6.000	1.00	1.00	

----- End of List -----



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Parts and Components of Engineering Master

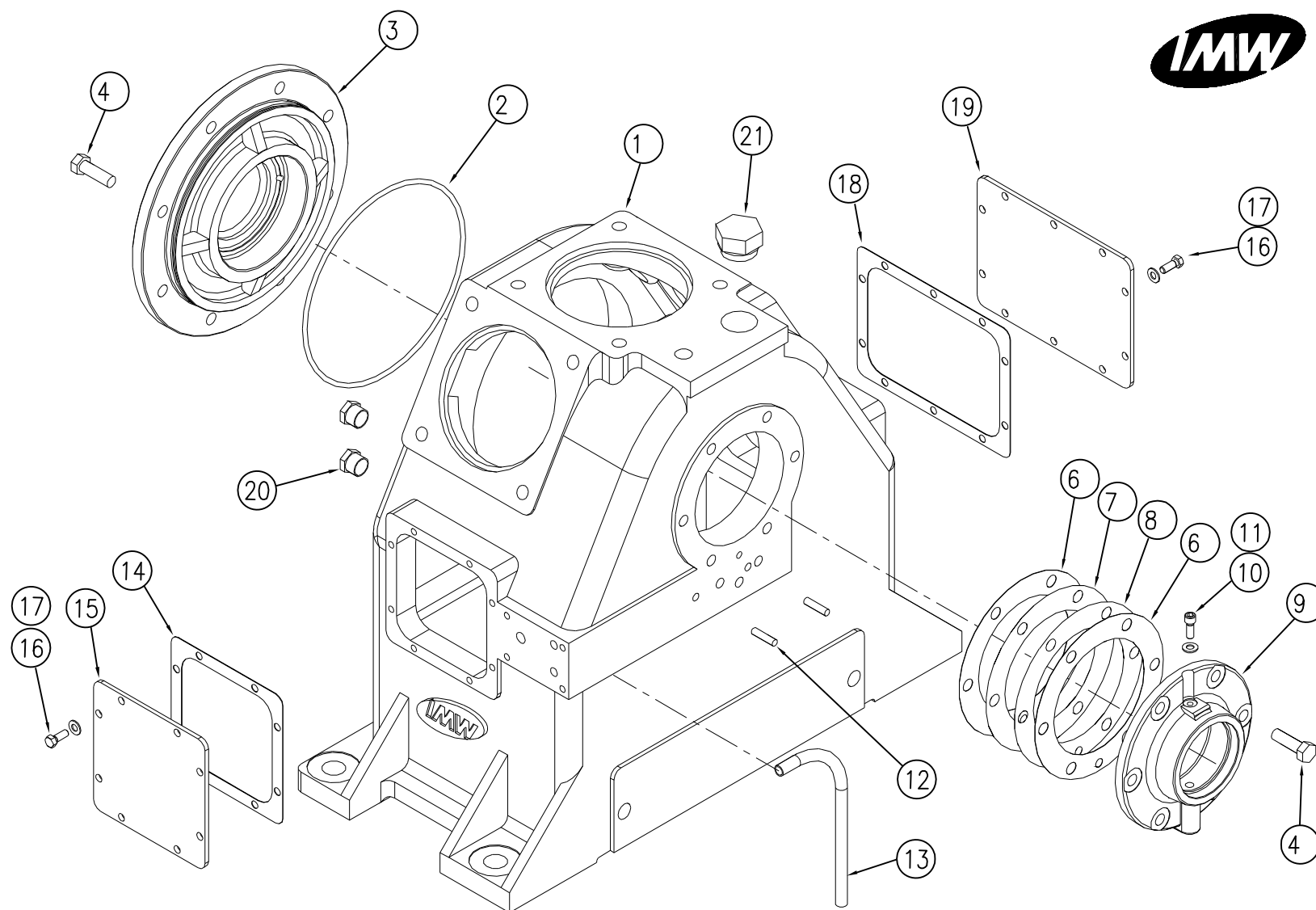
WorkOrder/Eng. Master: 400008-01

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01	.203394-00	IMW50 CRANKSHAFT MACHINING	1.00	1.00	
02	.311171	PLUG PIPE SOCKET HEAD CS 0.125IN	2.00	2.00	
03	.202692-00	PLUG 1/8NPT FILTER IMW50 & ALPHA3	1.00	1.00	
04	.202617-02-06	COUNTER WEIGHT	2.00	2.00	
05	.310800	WASHER LOCK HIGH COLLAR HEL 0.625	4.00	4.00	
06	.303652	SHCS CS 0.625-18UNF X 3.500	4.00	4.00	
07	.304808	RING RETAINING INT CS 1300 0100	4.00	4.00	
08	.202628-00	IMW50 CRANKCASE OIL PUMP DRIVING	1.00	1.00	
09	.308768	BEARING TAPER 6.375 X 3.375 X 1.875	2.00	2.00	
09	.308800	BEARING TAPER CONE 6.375 X 3.375 X 1.875	2.00	2.00	
10	.202633-00	IMW50 CRANKCASE OIL INTRODUCING	1.00	1.00	
11	.305582	ORING 2-244 N70D	2.00	2.00	
12	.306657	SEAL CRANKSHAFT	1.00	1.00	
13	.203409-00	KEY, 3/4 X 3/4 X 4 1/2 FOR IMW50 & ALPHA	1.00	1.00	

----- End of List -----



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IMW50 CRANKCASE ASSEMBLY
DRAWN BY KH, 2001-12-12
DRAWING # 2643-00 Rev. F BVK 2006-06-30
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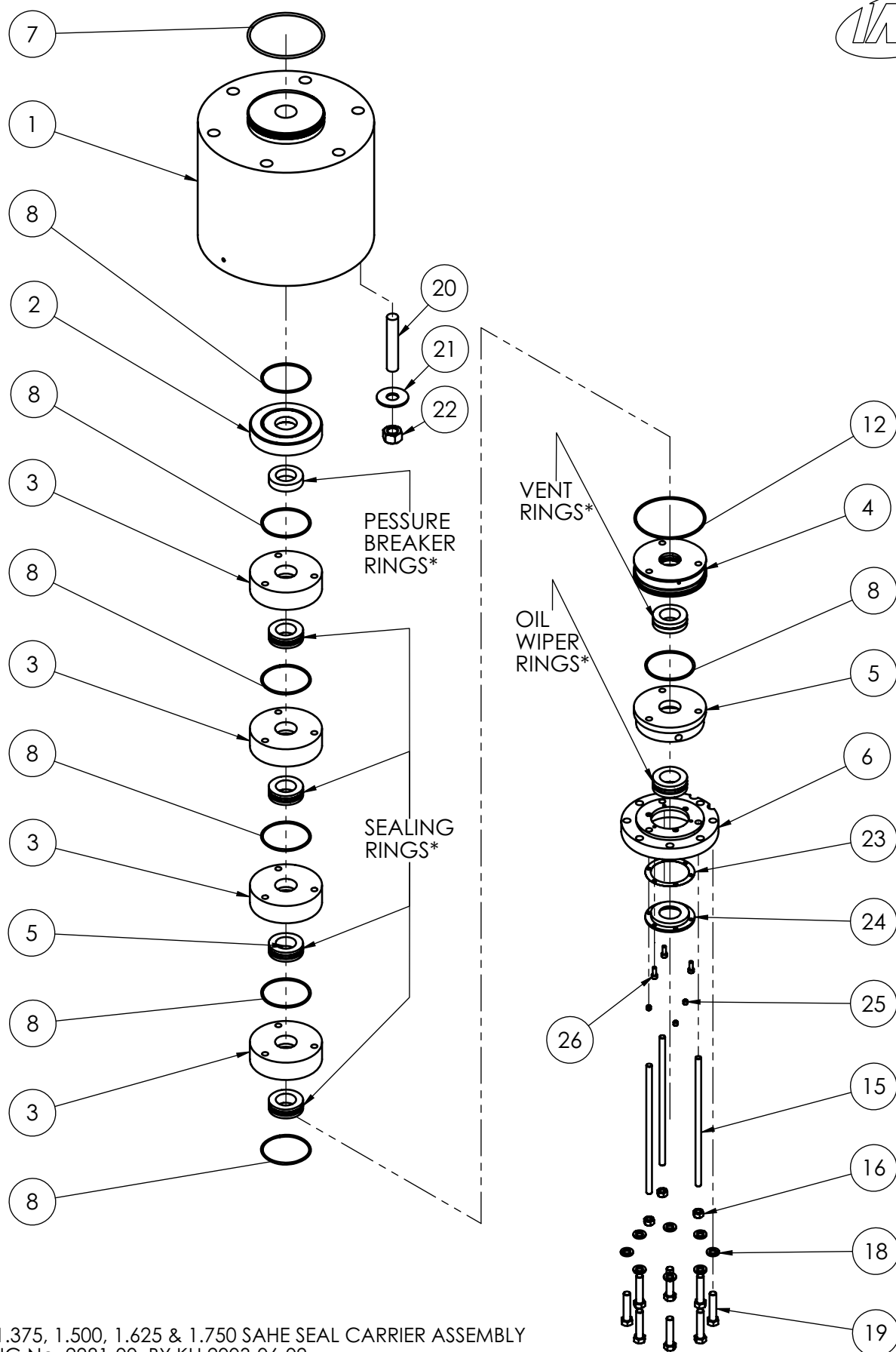
**Parts and Components of 202643-00 - REVISION E IS EFFECTIVE FROM
SERIAL NUMBER 8319.---SUB_ID: 0
WorkOrder/Eng. Master: 206058**

<i>Ref</i>	<i>Part ID</i>	<i>Description</i>	<i>QTY per Asm</i>	<i>QTY per W/O</i>	<i>Sub W/O</i>
-----	.206012	IMW50 OIL INTRODUCING RING RETAINER	1.00	1.00	
-----	.305603	ORING 2-252 N70D	1.00	1.00	
01	.204450	CRANKCASE IMW50 MACHINED W/ BLOCK	1.00	1.00	
02	.305663	ORING 2-276 N70D	1.00	1.00	
03	.202620-01	IMW50 CRANKCASE REAR COVER	1.00	1.00	
04	.301606	BOLT HH CS GR.5 0.625-11UNC X 1.750 ZN	14.00	14.00	
05	.304528	WASHER FLAT GR 8 0.625 PLATED	14.00	14.00	
06	.202645-00	IMW50 CRANKCASE FRONT COVER	2.00	2.00	
09	.206014	IMW50 CRANKCASE FRONT COVER -	1.00	1.00	
10	.303461	SHCS CS 0.375-16UNC X 1.000IN	1.00	1.00	
11	.308000	WASHER SEAL FLAT 0.375IN	1.00	1.00	
13	.202655-00	IMW50 CRANKCASE RELIEF VALVE DISCH.	1.00	1.00	
14	.202649-00	IMW50 CRANKCASE GASKET	1.00	1.00	
15	.202647-00	IMW50 CRANKCASE SQUARE COVER	1.00	1.00	
16	.301732	BOLT HH CS GR.5 0.375-16UNC X 0.750 ZN	18.00	18.00	
18	.202650-00	IMW50 CRANKCASE RECTANGULAR	1.00	1.00	
19	.202648-00	IMW50 CRANKCASE RECTANGULAR	1.00	1.00	
21	.305950	PLUG PIPE HEX CS 1.500MSAE	1.00	1.00	
22	.311171	PLUG PIPE SOCKET HEAD CS 0.125IN	2.00	2.00	

----- End of List -----



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IMW50 1.375, 1.500, 1.625 & 1.750 SAHE SEAL CARRIER ASSEMBLY

DRAWING No. 2981-00, BY KH 2003-06-09

LATEST REVISION C, BY DY 2007-08-15

BILL OF MATERIAL REFERS TO BOM-2981.DOC

PART NUMBERS FOR ITEMS MARKED WITH A (*) CAN BE FOUND IN THE RGV SCHEDULE



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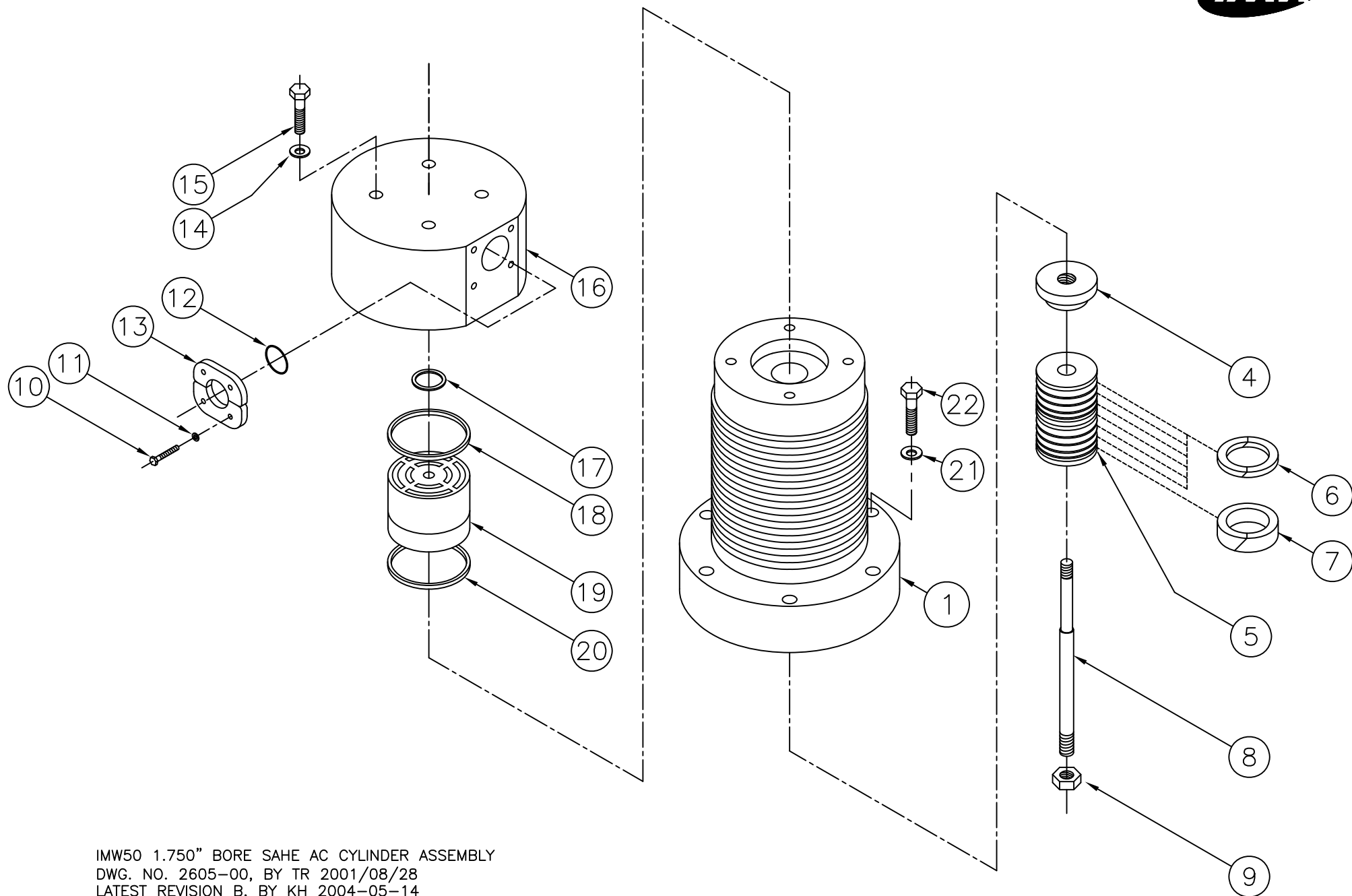
Parts and Components of 1ST, 2ND STAGE---SUB_ID: 0

WorkOrder/Eng. Master: 54425

<i>Ref</i>	<i>Part ID</i>	<i>Description</i>	<i>QTY</i> <i>per Asm</i>	<i>QTY</i> <i>per W/O</i>	<i>Sub</i> <i>W/O</i>
-----	..202981-00	SEAL CARRIER ASSY 1.375-1.750 BORE IMW5	1.00	2.00	
-----	..306557	ROD REDI CS GR.8 0.313UNF X 36.000 ZN	3.00	6.00	
-----	..304528	WASHER FLAT GR 8 0.625 PLATED	4.00	8.00	
01	..201160	SEAL CARRIER 1.375-1.750 BORE IMW50	1.00	2.00	
02	..202982-00	BREAKER RING CUP IMW50	1.00	2.00	
03	..202983-00	SEALING RING CUP IMW50	4.00	8.00	
04	..202984-00	VENT RING CUP IMW50	1.00	2.00	
05	..202985-00	OIL WIPER RING CUP IMW50	1.00	2.00	
06	..202986-00	BASE BLOCK IMW50	1.00	2.00	
07	..305579	ORING 2-242 V90D	1.00	2.00	
08	..327606	ORING 2-145 V90D	7.00	14.00	
12	..317021	ORING 2-153 V90D	1.00	2.00	
16	..307237	NUT HEX CS GR.8 0.313UNF PLATED	3.00	6.00	
17	..319204	WASHER LOCK HIGH COLLAR HEL 0.313	3.00	6.00	
18	..314804	WASHER LOCK GR 8 0.375 PLATED	8.00	16.00	
19	..301726	BOLT HH CS GR.5 0.375-16UNC X 1.750 ZN	8.00	16.00	
20	..202523-00	STUD 0.625IN X 3 1/2 LG	4.00	8.00	
22	..301765	NUT HEX CS GR.8 0.625UNC PLATED	4.00	8.00	
23	..202854-00	SHIM SEAL CARRIER RETAINER	1.00	2.00	
24	..201181	OIL WIPER RETAINER	1.00	2.00	
25	..305760	SHCS CS 10-24UNC X 0.500	3.00	6.00	
26	..305883	SCREW SOCKET SET 0.250-20UNC X 0.250	3.00	6.00	
-----	..202605-00	CYLINDER ASM 1.750 SAHE AC	1.00	2.00	
01	..202604-00-H	CYLINDER 1.750 SAHE AC IMW50 HARDENED	1.00	2.00	
04	..200837	NUT PISTON RETAINING 1.750	1.00	2.00	
05	..200836	PISTON 1.750 SAHE IMW 50	1.00	2.00	
08	..201262	ROD PISTON SA 3RD STAGE IMW50 21.062 LG	1.00	2.00	
09	..201278	NUT CROSSHEAD 1.063	1.00	2.00	
10	..303093	BOLT HH CS GR.8 0.375-16UNC X 1.250 PLT	4.00	8.00	
11	..314804	WASHER LOCK GR 8 0.375 PLATED	4.00	8.00	
12	..305505	ORING 2-219 V90D	1.00	2.00	
13	..310753	FLANGE SPLIT 1.000	2.00	4.00	
14	..304530	WASHER FLAT GR 8 0.750 PLATED	4.00	8.00	

<i>Ref</i>	<i>Part ID</i>	<i>Description</i>	<i>QTY</i> <i>per Asm</i>	<i>QTY</i> <i>per W/O</i>	<i>Sub</i> <i>W/O</i>
15	..301616	BOLT HH CS GR.5 0.750-10UNC X 5.500 ZN	4.00	8.00	
16	..201086-16F-16N	HEAD-24/54MM VALVE	1.00	2.00	
17	..201096	VALVE GASKET 38MM X 30MM X 0.040	1.00	2.00	
18	..201095	VALVE GASKET 3.135 X 2.756 X 0.040	1.00	2.00	
21	..304530	WASHER FLAT GR 8 0.750 PLATED	6.00	12.00	
22	..301614	BOLT HH CS GR.5 0.750-10UNC X 3.000 ZN	6.00	12.00	

----- End of List -----



IMW50 1.750" BORE SAHE AC CYLINDER ASSEMBLY
DWG. NO. 2605-00, BY TR 2001/08/28
LATEST REVISION B, BY KH 2004-05-14
BILL OF MAT'L REF. BOM-2605



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**Parts and Components of 202605-00(CYLINDER ASM 1.750 SAHE AC--
-SUB_ID: 109)**

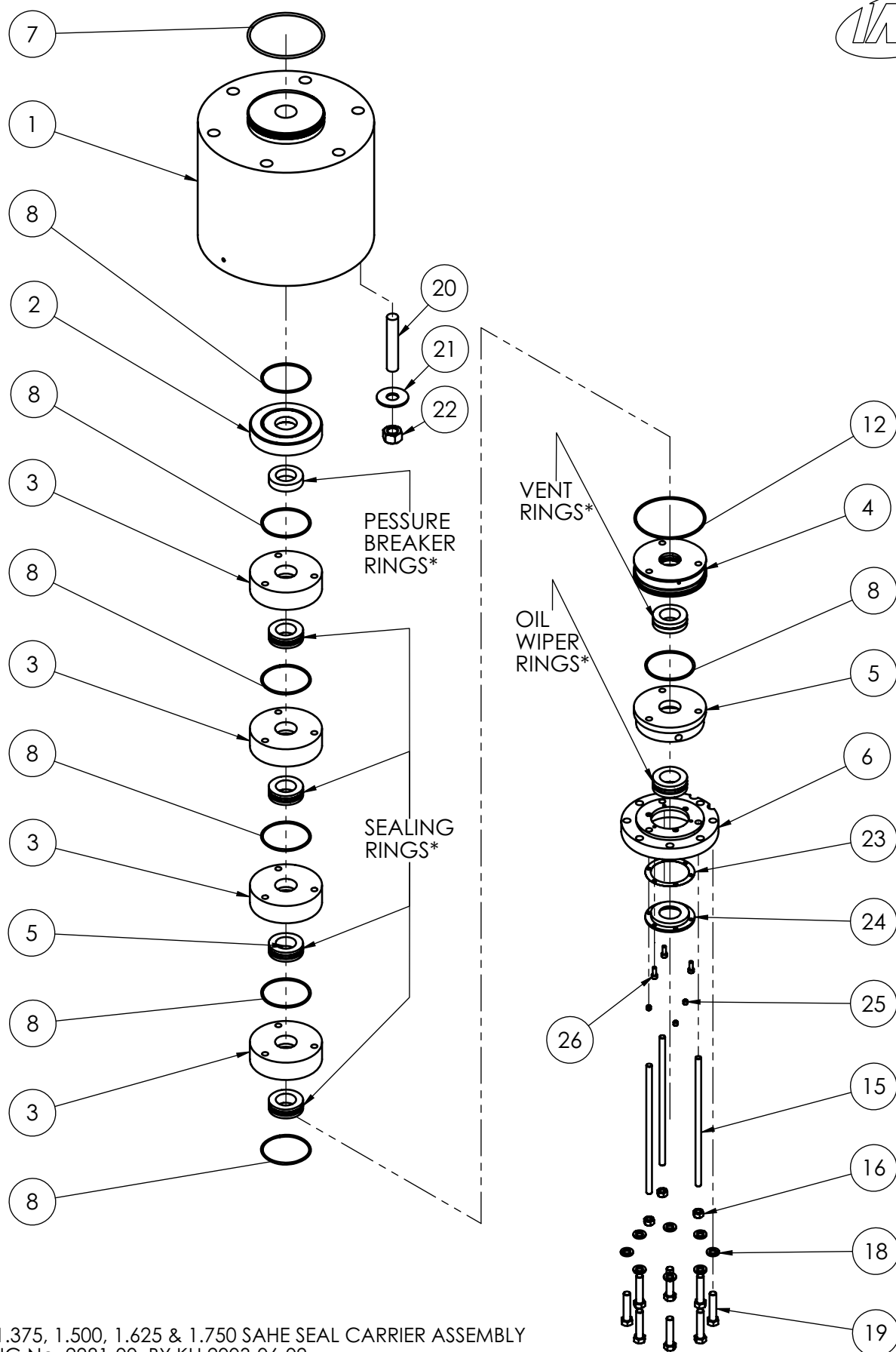
WorkOrder/Eng. Master: 54425

<i>Ref</i>	<i>Part ID</i>	<i>Description</i>	<i>QTY per Asm</i>	<i>QTY per W/O</i>	<i>Sub W/O</i>
01	.202604-00-H	CYLINDER 1.750 SAHE AC IMW50 HARDENEI	1.00	2.00	
04	.200837	NUT PISTON RETAINING 1.750	1.00	2.00	
05	.200836	PISTON 1.750 SAHE IMW 50	1.00	2.00	
08	.201262	ROD PISTON SA 3RD STAGE IMW50 21.062 LC	1.00	2.00	
09	.201278	NUT CROSSHEAD 1.063	1.00	2.00	
10	.303093	BOLT HH CS GR.8 0.375-16UNC X 1.250 PLT	4.00	8.00	
11	.314804	WASHER LOCK GR 8 0.375 PLATED	4.00	8.00	
12	.305505	ORING 2-219 V90D	1.00	2.00	
13	.310753	FLANGE SPLIT 1.000	2.00	4.00	
14	.304530	WASHER FLAT GR 8 0.750 PLATED	4.00	8.00	
15	.301616	BOLT HH CS GR.5 0.750-10UNC X 5.500 ZN	4.00	8.00	
16	.201086-16F-16 N	HEAD-24/54MM VALVE	1.00	2.00	
17	.201096	VALVE GASKET 38MM X 30MM X 0.040	1.00	2.00	
18	.201095	VALVE GASKET 3.135 X 2.756 X 0.040	1.00	2.00	
21	.304530	WASHER FLAT GR 8 0.750 PLATED	6.00	12.00	
22	.301614	BOLT HH CS GR.5 0.750-10UNC X 3.000 ZN	6.00	12.00	

----- End of List -----



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IMW50 1.375, 1.500, 1.625 & 1.750 SAHE SEAL CARRIER ASSEMBLY
DRAWING No. 2981-00, BY KH 2003-06-09

LATEST REVISION C, BY DY 2007-08-15

BILL OF MATERIAL REFERS TO BOM-2981.DOC

PART NUMBERS FOR ITEMS MARKED WITH A (*) CAN BE FOUND IN THE RGV SCHEDULE



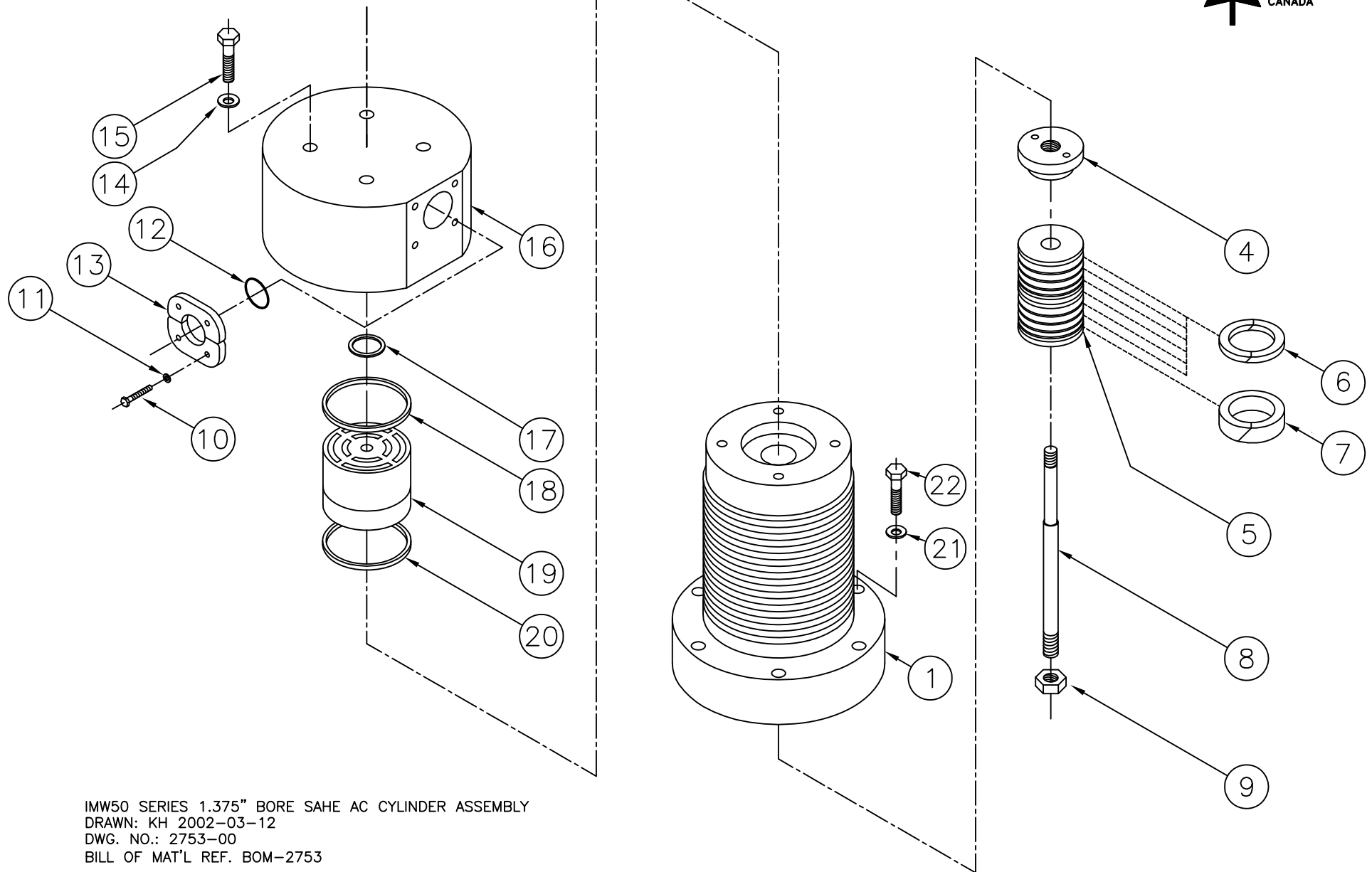
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Parts and Components of 1ST, 2ND STAGE---SUB_ID: 0

WorkOrder/Eng. Master: 54425

<i>Ref</i>	<i>Part ID</i>	<i>Description</i>	<i>QTY</i> <i>per Asm</i>	<i>QTY</i> <i>per W/O</i>	<i>Sub</i> <i>W/O</i>
-----	..202981-00	SEAL CARRIER ASSY 1.375-1.750 BORE IMW5	1.00	2.00	
-----	..306557	ROD REDI CS GR.8 0.313UNF X 36.000 ZN	3.00	6.00	
-----	..304528	WASHER FLAT GR 8 0.625 PLATED	4.00	8.00	
01	..201160	SEAL CARRIER 1.375-1.750 BORE IMW50	1.00	2.00	
02	..202982-00	BREAKER RING CUP IMW50	1.00	2.00	
03	..202983-00	SEALING RING CUP IMW50	4.00	8.00	
04	..202984-00	VENT RING CUP IMW50	1.00	2.00	
05	..202985-00	OIL WIPER RING CUP IMW50	1.00	2.00	
06	..202986-00	BASE BLOCK IMW50	1.00	2.00	
07	..305579	ORING 2-242 V90D	1.00	2.00	
08	..327606	ORING 2-145 V90D	7.00	14.00	
12	..317021	ORING 2-153 V90D	1.00	2.00	
16	..307237	NUT HEX CS GR.8 0.313UNF PLATED	3.00	6.00	
17	..319204	WASHER LOCK HIGH COLLAR HEL 0.313	3.00	6.00	
18	..314804	WASHER LOCK GR 8 0.375 PLATED	8.00	16.00	
19	..301726	BOLT HH CS GR.5 0.375-16UNC X 1.750 ZN	8.00	16.00	
20	..202523-00	STUD 0.625IN X 3 1/2 LG	4.00	8.00	
22	..301765	NUT HEX CS GR.8 0.625UNC PLATED	4.00	8.00	
23	..202854-00	SHIM SEAL CARRIER RETAINER	1.00	2.00	
24	..201181	OIL WIPER RETAINER	1.00	2.00	
25	..305760	SHCS CS 10-24UNC X 0.500	3.00	6.00	
26	..305883	SCREW SOCKET SET 0.250-20UNC X 0.250	3.00	6.00	
-----	..202605-00	CYLINDER ASM 1.750 SAHE AC	1.00	2.00	
01	..202604-00-H	CYLINDER 1.750 SAHE AC IMW50 HARDENED	1.00	2.00	
04	..200837	NUT PISTON RETAINING 1.750	1.00	2.00	
05	..200836	PISTON 1.750 SAHE IMW 50	1.00	2.00	
08	..201262	ROD PISTON SA 3RD STAGE IMW50 21.062 LG	1.00	2.00	
09	..201278	NUT CROSSHEAD 1.063	1.00	2.00	
10	..303093	BOLT HH CS GR.8 0.375-16UNC X 1.250 PLT	4.00	8.00	
11	..314804	WASHER LOCK GR 8 0.375 PLATED	4.00	8.00	
12	..305505	ORING 2-219 V90D	1.00	2.00	
13	..310753	FLANGE SPLIT 1.000	2.00	4.00	
14	..304530	WASHER FLAT GR 8 0.750 PLATED	4.00	8.00	

<i>Ref</i>	<i>Part ID</i>	<i>Description</i>	<i>QTY</i> <i>per Asm</i>	<i>QTY</i> <i>per W/O</i>	<i>Sub</i> <i>W/O</i>
15	..301616	BOLT HH CS GR.5 0.750-10UNC X 5.500 ZN	4.00	8.00	
16	..201086-16F-16N	HEAD-24/54MM VALVE	1.00	2.00	
17	..201096	VALVE GASKET 38MM X 30MM X 0.040	1.00	2.00	
18	..201095	VALVE GASKET 3.135 X 2.756 X 0.040	1.00	2.00	
21	..304530	WASHER FLAT GR 8 0.750 PLATED	6.00	12.00	
22	..301614	BOLT HH CS GR.5 0.750-10UNC X 3.000 ZN	6.00	12.00	
----- End of List -----					

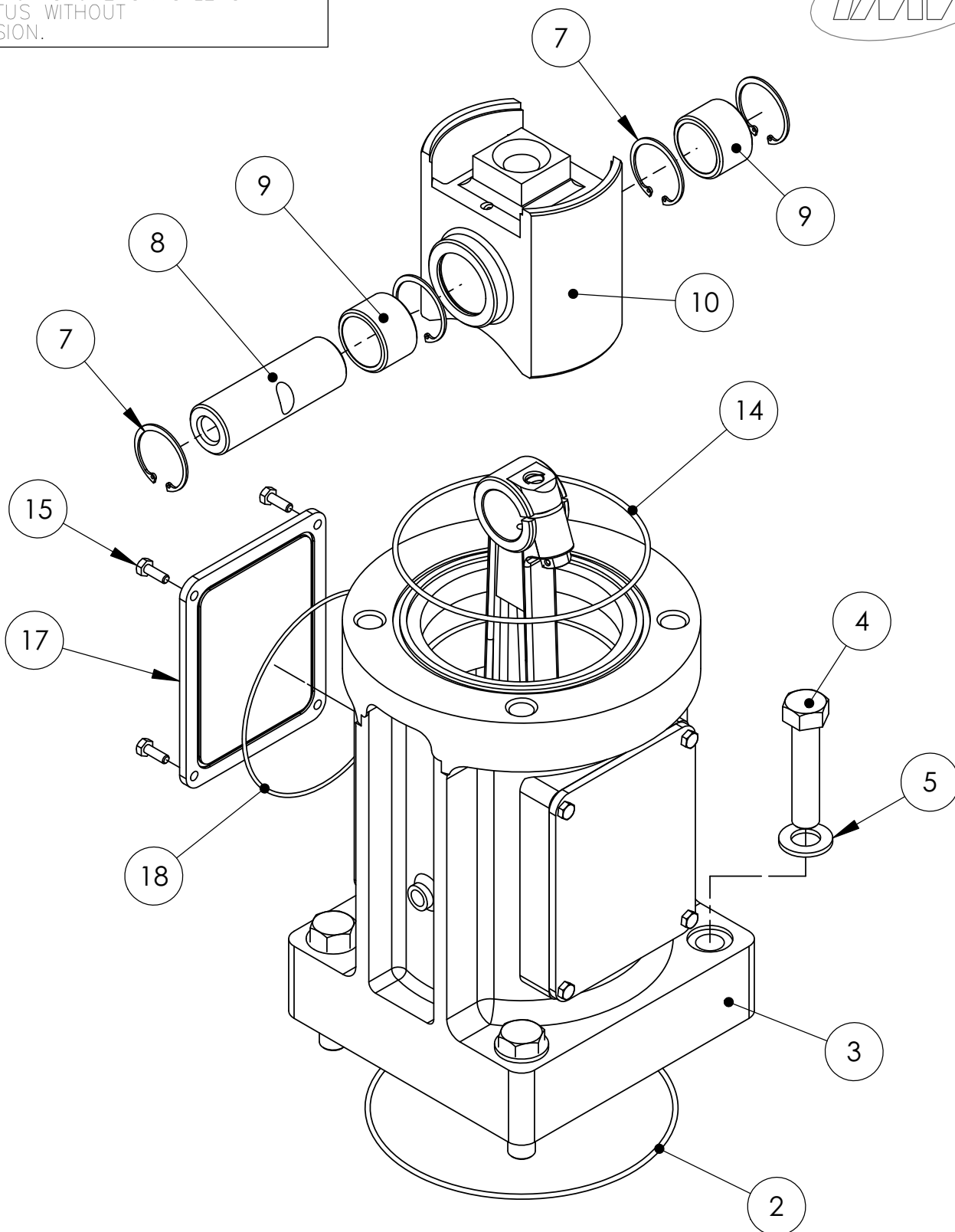


IMW50 SERIES 1.375" BORE SAHE AC CYLINDER ASSEMBLY
 DRAWN: KH 2002-03-12
 DWG. NO.: 2753-00
 BILL OF MAT'L REF. BOM-2753



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CROSSHEAD & CROSSHEAD GUIDE ASSEMBLY
IMW50 SINGLE ACTING WINGS, EXTERNALLY LUBRICATED
DRAWING # 1313-00, BY TH 1995-04-27
LATEST REVISION G, BY DVL 2005-10-26
BILL OF MATERIALS REFERS TO BOM-1313.DOC



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**Parts and Components of 201313(CROSSHEAD GUIDE ASM SA INT. LUBE-
--SUB_ID: 0)**

WorkOrder/Eng. Master: 54425

<i>Ref</i>	<i>Part ID</i>	<i>Description</i>	<i>QTY per Asm</i>	<i>QTY per W/O</i>	<i>Sub W/O</i>
-----	.305634	ORING 2-267 N70D	1.00	3.00	
-----	.202773-01	CROSSHEAD GUIDE IMW50	1.00	3.00	
-----	.301614	BOLT HH CS GR.5 0.750-10UNC X 3.000 ZN	4.00	12.00	
-----	.304530	WASHER FLAT GR 8 0.750 PLATED	4.00	12.00	
-----	.304813	RING RETAINING INT CS 1300 187	4.00	12.00	
-----	.200300	WRIST PIN FOR 5.5IN CROSSHEAD	1.00	3.00	
-----	.309654	BEARING NEEDLE WRISTPIN	2.00	6.00	
-----	.201351	CROSSHEAD 5.5 DIA-MACHINING-NEEDLE B	1.00	3.00	
-----	.305623	ORING 2-261 N70D	1.00	3.00	
-----	.304403	BOLT HH CS GR.5 0.250-20UNC X 0.750 ZN	8.00	24.00	
-----	.203408-00	COVER PLATE IMW50/ALPHA3	2.00	6.00	
-----	.317111	ORING 2-163 N70D	2.00	6.00	

----- End of List -----



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IMW COMPRESSOR MANUAL INSTALLATION DOCUMENT LIST

The installation section of the IMW compressor manual consists mainly of drawings used for site layout and design, as well as piping schematics. Included in this section will also be any useful procedures related to or preceding installation.

As with the Main Document List, this document lists the complete set of items that comprise the IMW compressor manual installation appendix.

Description	Document Number	Revision	Pages
IMW COMPRESSORS INSTALLATION GUIDELINES	WI-SV-2009-007	0	3
GENERAL ARRANGEMENT DRAWING	240202	A	1
SKID DRAWING	208066	A	1
PROJECT DRAWING / FORM LIST	FO-EN-2008-001	0	1
ELECTRICAL CALCULATION REPORT	FO-EN-2007-002	A	2
CONTROL PANEL SCHEMATICS	450068-XX	D	12
CONDUIT AND INSTALLATION SCHEDULE	450069-XX	C	7
CONTROL PANEL COOLING	450091-XX	A	1
COMPRESSOR GAS PIPING IMW50	400326-XX	D	1
COMPRESSOR GAS PIPING BILL OR MATERIALS	400326-01	F	1
IMW50 COMPRESSOR LUBRICATION CIRCUIT	400046-XX	N/A	1
IMW50 COMPRESSOR LUBRICATION CIRCUIT BILL OF MATERIALS	400046-02	0	1
PRIORITY PANEL	207371	A	1



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	Document Title IMW COMPRESSORS INSTALLATION GUIDELINES			Document # WI-SV-2009-007	Rev. # 0
	Prepared By Ahmed Elsaadawy	Approved By Martin Loffler	Issue Date (yyyy/mm/dd) 2009/08/26	Page 1 of 3	

Notice: Recommendations given in this document are for guideline purposes only and should be followed along with the local codes and regulations of the country of installation.

1.0 GENERAL SITE LAYOUT:


- 1.1 The site layout design **MUST** meet the local code(s) for classification of hazardous areas.
- 1.2 The compressor must have adequate space around the compressor skid for easy maintenance access. Please refer to IMW GA drawings for skid dimensions.
- 1.3 For skids without an enclosure, if the compressor is to be installed inside a bunker, the bunker must have adequate air flow for proper ventilation. Please refer to ventilation requirements on IMW GA drawing.
- 1.4 The inlet gas pipe(s) should be routed so that maintenance access for the unit is not impeded.
- 1.5 An emergency entrance and exit to the unit must be provided and kept clear of obstacles.

2.0 COMPRESSOR CONCRETE PAD, DISPENSER ISLAND AND TRENCHES:

- 2.1 The civil work for the concrete pad must be completed by a specialized Civil engineer. Static and dynamic loads should be considered in the concrete pad design.

2.2 The concrete pad **MUST** be perfectly level. It is **HIGHLY** important that the surface finish be free of uneven spots for smooth operation (low vibration levels) of the compressor.

- 2.3 When designing the concrete pad, cut-aways must be considered for cables, piping and stainless steel tubes.
- 2.4 Trenches/conduits for cables, stainless steel tubing and piping between the skid, MCC panels, and dispensers/fill posts should be considered during the construction of the station.
- 2.5 If open-type trenches will be used, the trenches have to have proper covers and should have brackets and supports for stainless steel tubes, pipes and cables with respect to local codes.
- 2.6 For buried PVC conduits, **ONLY** coiled stainless steel tubing can be used (no connections or fittings to be used in buried conduits). Local codes for proximity from building and other utilities should be considered.
- 2.7 The Design for the dispenser island should consider the following:
 - i. Manholes for dispenser cables and stainless steel tubes connections
 - ii. A steel frame to bolt down the dispensers
 - iii. Above-ground access with a reasonably raised height
 - iv. Fenders to protect the dispensers

	Document Title IMW COMPRESSORS INSTALLATION GUIDELINES			Document # WI-SV-2009-007	Rev. # 0
	Prepared By Ahmed Elsaadawy	Approved By Martin Loffler	Issue Date (yyyy/mm/dd) 2009/08/26	Page 2 of 3	

3.0 SKID AND ENCLOSURE:

3.1 The lifting pins should be used for pulling the skid out of the shipping container and **MUST be removed after positioning the compressor on the concrete pad.**

3.2 The skid **MUST** be level and the proper anchor bolts **MUST** be used.

3.3 **If the concrete pad is not perfectly even and level**, then, one of the following methods **MUST** be used for mounting the compressor skid on the concrete pad:

- i. Vibration isolation mounts (dampeners)
- ii. An epoxy or cement base grout to fill any gaps between the skid and the concrete pad - in this case no anchoring bolts are required
- iii. A reinforced rubber sheet(s), 1" thick can be used to eliminate any uneven spots in the concrete pad

3.4 The skid chassis must be bonded to a sufficient ground source as dictated by local codes (earthed).

3.5 For units with enclosure, the enclosure must be anchored to the concrete pad with the provided anchoring brackets.

4.0 INLET GAS PIPING:

4.1 The provided inlet strainer, flexible hose, check valve and manual shut-off valve must be installed.

4.2 An inlet filter should be installed and the inlet piping should be properly clamped and supported.

5.0 STORAGE CASCADE:

5.1 The storage rack must be anchored and grounded (earthed).


5.2 The vent for the relief valves must be plumbed to a safe height into the atmosphere.

6.0 STAINLESS STEEL TUBING:

6.1 The stainless steel tubes used must be correctly rated for the design pressure and sized adequately for the required flow rates.

6.2 The stainless steel tubes must be clamped and supported at adequate distances as per local code, and Dielectric fittings should be used.

7.0 ELECTRIC PANEL (MCC PANEL):

	Document Title IMW COMPRESSORS INSTALLATION GUIDELINES			Document # WI-SV-2009-007	Rev. # 0
	Prepared By Ahmed Elsaadawy	Approved By Martin Loffler	Issue Date (yyyy/mm/dd) 2009/08/26	Page 3 of 3	

7.1 The MCC panel must be located in a non-hazardous location (unless otherwise stated by IMW) and must be anchored to the ground.

7.2 AIR COMPRESSOR AND AIR PIPES:

7.2.1 The air compressor must be installed in a non-hazardous location.

7.2.2 The air pipes must be sized correctly for pressure drop and desired air flow. A condensate separator or a dryer should be incorporated (if applicable).

7.3 ENGINE SILENCER:

7.3.1 The engine silencer should be installed down-the-wind with correct size pipes and to be supported and clamped properly.

7.4 ENGINE COOLING SYSTEMS:

7.4.1 ENGINE RADIATOR:

7.4.1.1 The radiator must be located in a non-hazardous location with good ventilation.

7.4.1.2 Pipes/hoses between the radiator and the engine **MUST** be properly sized for the existing distance.

7.4.2 PLATE HEAT EXCHANGERS (*THIS ALSO APPLIES TO ELECTRIC-DRIVEN WATER-COOLED UNITS*):

7.4.2.1 The pipes used between the plate heat exchanger and the cooling tower **MUST** be properly sized for the existing distance.

7.4.2.2 Pressure gauges should be installed on the inlet and outlet of the plate heat exchanger.

8.0 DISPENSERS AND FILL POSTS:

8.1 The dispenser/fill post area **MUST** be classified as a CLASS I DIV 1 area.

8.2 The dispenser/fill post must be bolted down to the island and grounded (earthed).

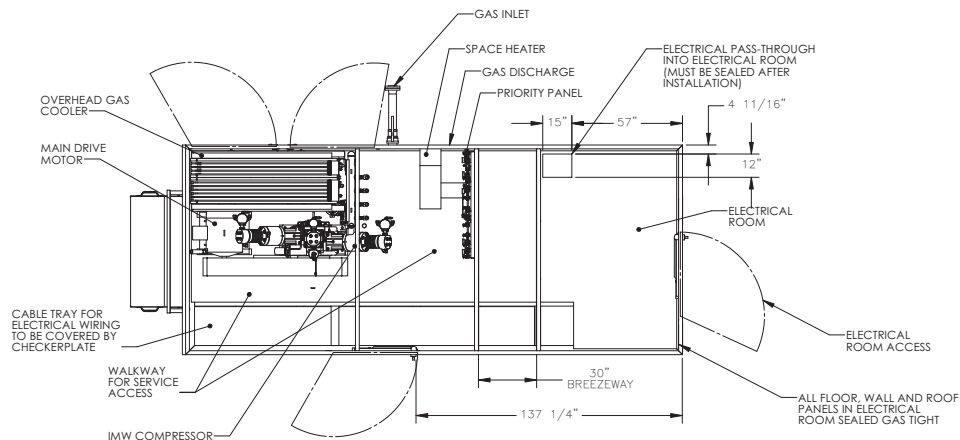
8.3 The canopy lights **MUST** be EX-proof or be raised high enough to meet the minimum distance for hazardous area classification.



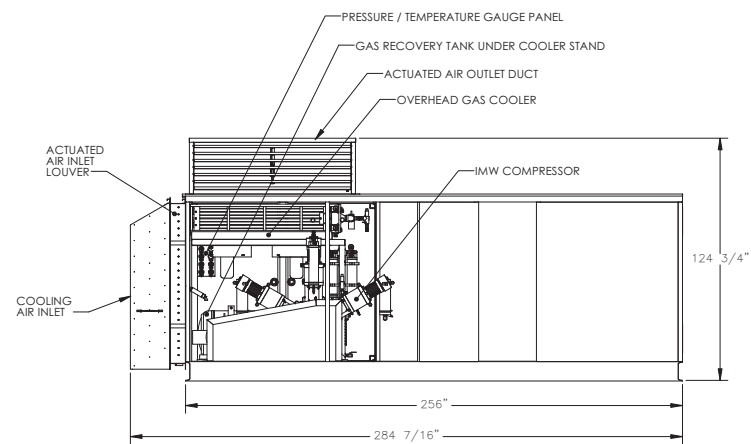
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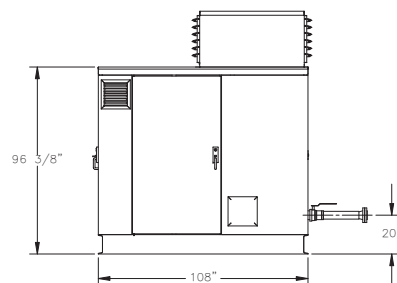
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REV.	DATE	BY	CHK.	DCR#	REFERENCE	
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A	2011/02/08	BJN	KWH	N/A	ADDED DETAILS FOR FIRST RELEASE	



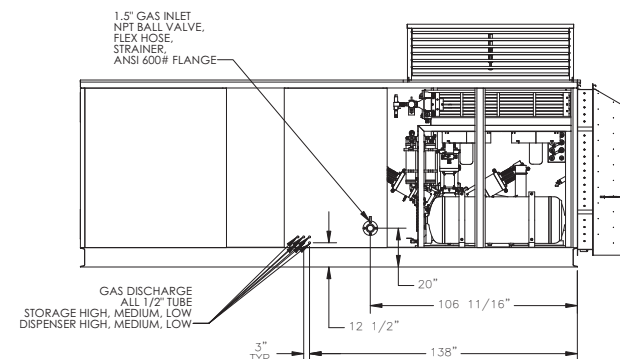
TOP VIEW WITH ROOF PANELS REMOVED



FRONT VIEW WITH DOOR AND WALL PANEL REMOVED



ELECTRICAL ROOM END VIEW



REAR VIEW WITH DOORS REMOVED

- NOTES:
1. THIS PACKAGE INTENDED TO BE MOUNTED ON AND WELDED TO PILES. SEE SKID DRAWING FOR BEAM LOCATIONS.
 2. TO ENSURE ADEQUATE AIR MOVEMENT, NO WALL SHOULD BE CLOSER THAN TEN FEET FROM THE AIR INLETS OR OUTLETS SHOWN.
 3. ELECTRICAL CLASSIFICATION INSIDE THE ENCLOSURE IS CLASS I, DIV 2, GROUP D.
 4. ELECTRICAL CLASSIFICATION OUTSIDE THE ENCLOSURE UP TO 10 FEET IS CLASS I, DIV 2, GROUP D.

TITLE		IMW Industries Ltd. Chilliwack, BC, Canada	
COMPRESSOR IMW50-2X1750SA-75-4500-2AC			
REF. I STANDARD	SIZE	FILE NO.	REV
DR. BJN	2010/11/13	D	240202
CHK. KWH	2010/11/13	240202	A
AP. I	SCALE	1:32	WEIGHT 20000.0 (LBS)
			SHEET 1 / 1



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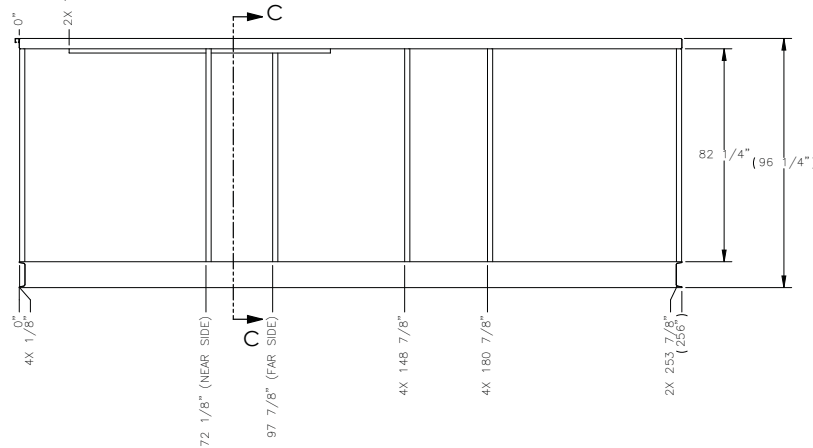
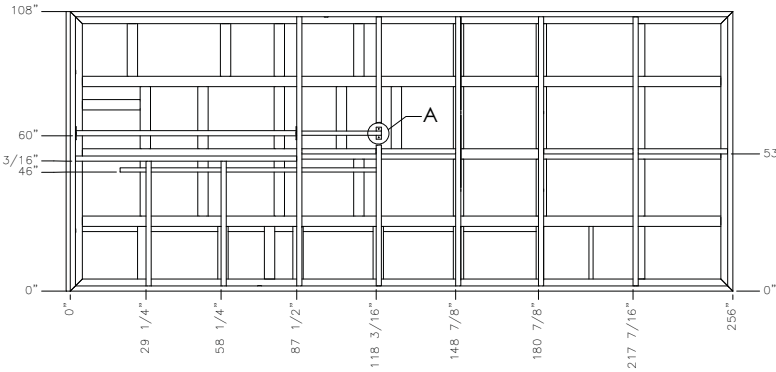
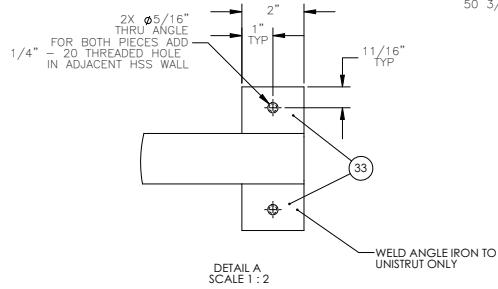
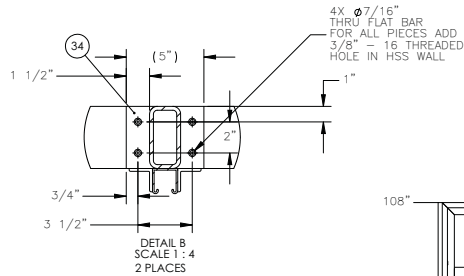
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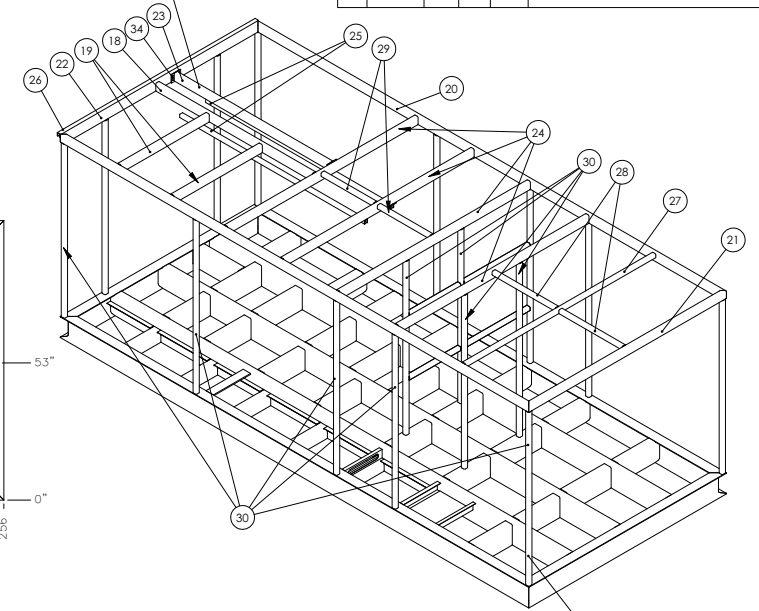
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PERMISSION.

REVISION HISTORY

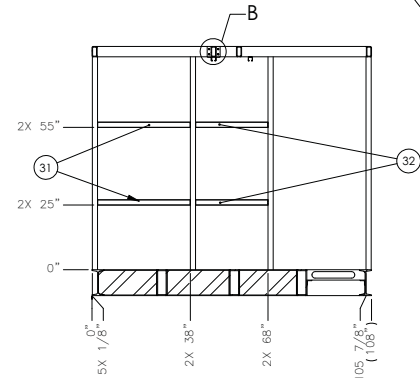
REV.	DATE	BY	CK.	DCR#	REFERENCE
-	-	-	-	-	See Sheet I



MEMBER IS REMOVEABLE



OFFSET ALL VERTICAL
POSTS BY 1/8" TOWARDS
THE CENTER SO THAT
SHEET METAL CAN BE
PLACED OVER THE POSTS



SECTION C-C

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION	CUT LENGTH	ANGLE1	ANGLE2	WEIGHT
18	1	312550	HSS CS A500 4.000 X 2.000 X 0.250	85.375	0	0	62.3
19	2	312550	HSS CS A500 4.000 X 2.000 X 0.250	48.188	0	0	35.2
20	2	312550	HSS CS A500 4.000 X 2.000 X 0.250	256	45	45	185.3
21	1	312550	HSS CS A500 4.000 X 2.000 X 0.250	108	45	45	77.3
22	1	312550	HSS CS A500 4.000 X 2.000 X 0.250	108	45	45	77.3
23	1	312550	HSS CS A500 4.000 X 2.000 X 0.250	84.938	0	0	62.0
24	4	312550	HSS CS A500 4.000 X 2.000 X 0.250	104	0	0	75.9
25	2	309643	UNISTRUT 1.625 X 1.625 x 12ga	100.94	0	0	15.8
26	1	309643	UNISTRUT 1.625 X 1.625 x 12ga	108	0	0	16.9
27	1	303560	HSS CS A500 2.000 X 2.000 X 0.250	103.938	0	0	46.5
28	2	303560	HSS CS A500 2.000 X 2.000 X 0.250	34.5	0	0	15.4
29	2	303560	HSS CS A500 2.000 X 2.000 X 0.250	28.625	0	0	12.8
30	16	303560	HSS CS A500 2.000 X 2.000 X 0.250	82.25	0	0	36.8
31	4	303560	HSS CS A500 2.000 X 2.000 X 0.250	35.813	0	0	16.0
32	4	303560	HSS CS A500 2.000 X 2.000 X 0.250	27.938	-	-	12.5
33	2	301888	ANGLE CS A36 1.500 X 1.500 X 0.188	2	0	0	0.3
34	2	301855	BAR FLAT W44/A36 HR 0.250 X 4.000 CS	5	0	0	1.4
35	2	305193	ANGLE CS A36 2.000 X 2.000 X 0.250	23.5	0	0	6.1
36	6	305193	ANGLE CS A36 2.000 X 2.000 X 0.250	27	0	0	7.0
37	2	305193	ANGLE CS A36 2.000 X 2.000 X 0.250	25	0	0	6.5
38	2	305193	ANGLE CS A36 2.000 X 2.000 X 0.250	28	0	0	7.2

DIMENSIONING & TOLERANCING PER: ASME Y14.5M-1994, U.S.O.				MW INDUSTRIES LTD. Chilliwack, BC, Canada			
TOLERANCES UNLESS OTHERWISE SPECIFIED:				ENCL/SKID WELDMENT ELEC W/ ELEC ROOM			
UNITS	INCHES	1/4	±1/16	REF. STANDARD	SIZE	NO.	REV.
FINISH	64 MICRO IN.	1/4	±1/16	OR FAS	2011/02/11	208066	A
INNER RAD.	.03 MAX	1/4	±.01	OR FAS	2011/02/11		
OUTER RAD.	.03 MAX	1/4	±.01	OR FAS	2011/02/11		
EDGE	1/4 MAX	1/4	±.01	OR FAS	2011/02/11		
SHEET 2 / 2				WEIGHT 7942.5 LBS			

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PROJECT DRAWING/FORM LIST

Customer Name:	DEVON CANADA		
Project Name:	DUNVEGAN GAS PLANT	Work Order #:	52491

CATEGORY: ELECTRICAL

Dwg. No. / Form	Rev.	Description	Line Notes	Qty. Req.	Doc. Rev.
450068	D	ELECTRIC DRIVE W/ SKID ELECTRICAL ROOM	-	1	C
450069	C	CONDUIT & INSTALLATION SCHEMATIC	-	1	B
450091	A	CONTROL PANEL COOLING	-	1	B

Line Notes:

DOCUMENT REVISIONS

Doc. Rev.	Description	Date yyyy-mm-dd	By	Issued To	Issued By (Sign/Date)
A	ORIGINAL	2011-02-17	IB	SHOP	
B	DRAFTING CORRECTIONS MADE, SEE INDIVIDUAL DWGS FOR SPECIFICS	2011-03-17	KL	SHOP	
C	AS-BUILT UPDATES	2011-03-30	IB	CUST	



PROJECT DRAWING/FORM LIST

OPTION	DESCRIPTION	USED X
	NOTE: SHADED OPTIONS DENOTE NON-UNIVERSAL SELECTIONS	NOT USED -
1	COMPRESSOR COOLER: HEAT EXCH (HX) OR TOWER FAN (TF)	HX
1A	AIR COOLED: NUMBER OF COOLER FANS	2
1B	WATER COOLED: HEAT EXCH (HX) OR WATER TOWER TYPE (TP) (NO PUMP) (W/PUMP)	-
1C	WATER COOLED: COOLANT PUMP	-
1D	WATER COOLED: COOLANT FLOW SWITCH	-
1E	WATER COOLED: SEPARATE SKID VENT FAN	-
2	COMPRESSOR OIL PRESSURE (NONE, ANALOG, DISCRETE)	(DISC)
3	UNLOADER SOLENOID	-
4	COMPRESSOR MANIFOLD TEMPERATURE SWITCH	-
5	DRIVE TYPE: WYE-DELTA, SOFT START, VARIABLE FREQUENCY OR ENGINE (YD, SS, VFD, ENG)	(SS)
6A	NEC 500 (CEC-ANNEX J) CLASS I DIVISION (1) OR (2)	2
6B	NEC 505 (CEC-SEC.18) CLASS I ZONE (1) OR (2)	-
6C	ATEX CLASSIFICATION (Ex II 3G) (Ex II 2G)	-
7	SKID GAS DETECTION (CUST OR IMW SUPPLIED)	X (IMW)
8	SKID LIGHTING	X
9	3 BANK PRIORTIY PANEL W/ ESD	X
10	BUFFER PRIORITY	-
11	NUMBER OF DISPENSERS / POWERED FILLPOSTS (POWER SUPPLIED FROM CONTROL CABINET)	1
12	ALARM HORN	-
13	AIR COMPRESSOR (IF USED SPECIFY IMW OR CUST)	-
14	ENGINE COOLER HEAT EXCH (HX) OR WATER TOWER TYPE (TP) (NO PUMP) (W/PUMP)	-
14A	ENGINE COOLING TOWER PUMP	-
14B	ENGINE TURBO COOLANT LEVEL SWITCH	-
14C	ENGINE COOLANT TEMPERATURE SWITCH	-
15	COMPRESSOR OIL BLOCK HEATER	X
16	COMPRESSOR OIL LEVEL SWITCH (USED WITH OPTION 15)	X
17	DISPENSER GAS DETECTION (CUST OR IMW SUPPLIED)	-
18	SKID ACTUATED LOUVERS	X
19	REMOTE MONITORING CAPABILITY	X
20	SPACE HEATER	X
21	GAS DRYER POWER SUPPLY	-
22	ELECTRICAL PANEL COOLING FAN	X
23	VARIABLE FREQUENCY DRIVE (COOLER FAN)	-
24	UNINTERRUPTABLE POWER SUPPLY (CUST OR IMW SUPPLIED)	X (IMW)
25	VOLTAGE/PHASE MONITORING	X
26	ANTI-CONDENSATION HEATER(S) (MAIN MOTOR)	-
27	MAIN MOTOR THERMOSTAT(S)	X
28	MAIN COMPRESSOR DISCONNECT	-
29	MAIN MOTOR DISCONNECT BREAKER	X
30	TEMP SWITCH GAUGES (FOR PLC INPUT)	-
31	INTERSTAGE THERMOCOUPLES (FOR PLC INPUT)	X
32	INTERSTAGE PRESSURE TRANSMITTERS	X
33	THIRD PARTY INSPECTION	-
34	MECHANICALLY OPERATED PRIORITY PANEL	-
SPECIAL 1	REVERSIBLE HX FANS	X
SPECIAL 2	ATTACHED ELECTRICAL ROOM	X
SPECIAL 3	COMPLETE COLD WEATHER PACKAGE	X
SPECIAL 4	ELECTRICAL ROOM BASEBOARD HEATER AND VENT FAN	X
SPECIAL 5		

Devon, CN - WO 52491

Electrical Calculations Single 75HP Compressor Skid

1 X 75 HP Main motor listed FLA: (FLA: 85.9) @ 480 volt 60 hz

2 X 2 HP Cooler/Vent Fan motor listed FLA: (FLA: 2.77) @ 480 volt 60 hz

1 X 10kW Space heater: (FLA: 12.0) @ 480 volt 60 hz

1 X 3kVA Control Transformer (120VA) (FLA: 6.25) @ 480 volt 60 hz

Total current draw for the compressor package is $1 \times 85.9 + 2.77 + 12.0 + 6.25 = 109.69$ amps @ 480 volt, 60hz.

Main Circuit Breaker (Motors):

Maximum: Largest Motor FLA x 200% + Sum of the FLA of all motors = 177.4 Amps

Therefore, one **150 amp** Circuit Breaker per motor set shall be used Table 29 & D16 of CEC

Main Motor Conductors:

Main motor Starting method: Solid state soft starter

Pre-Starter wiring:

Single conductors: $85.9 \times 125\% = 107.4$ amps = # 2 AWG

Table 2 of CEC

Note: Use copper conductors only.

Motor Connection wiring (parallel):

$85.9 \text{ amps} \times 125\% = 107.4 \text{ amps}$

Table 2 of CEC

Therefore # 2 AWG conductors in 3-conductor cables or conduits.

Table 6 of CEC

Recommended conduit 2 X 1.5" (minimum 2 X 1.5")

Overload setting = 86 amps

Cooler motor conductors:

Cooler motor Starting method: Direct on line

$2.77 \text{ amps} @ 125\% \text{ load} = 3.47 \text{ amps}$

Therefore # 14 awg (minimum)

Table 2 of CEC

#14 awg (recommended) conductors are to be used

Recommended conduit 1/2"

Table 6 of CEC

Maximum compressor power consumption:

$109.69 \text{ amps} \times 480\text{V} \times \text{square root of } 3 = 91.2 \text{ KVA}$

Circuit breaker Summary: Reference drawing #450068

CB1 = 150 Amp (Min IR of 30k.a)

CB/OL2 = 2.2 – 3.2 Amp

CB2 = N/A

CB/OL3 = 2.2 – 3.2 Amp

CB3 = N/A

CB/OL8 = 1.4 – 2.0 Amp


CB5 = 30A

CB6 = 15A




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DRAWING REVISION HISTORY

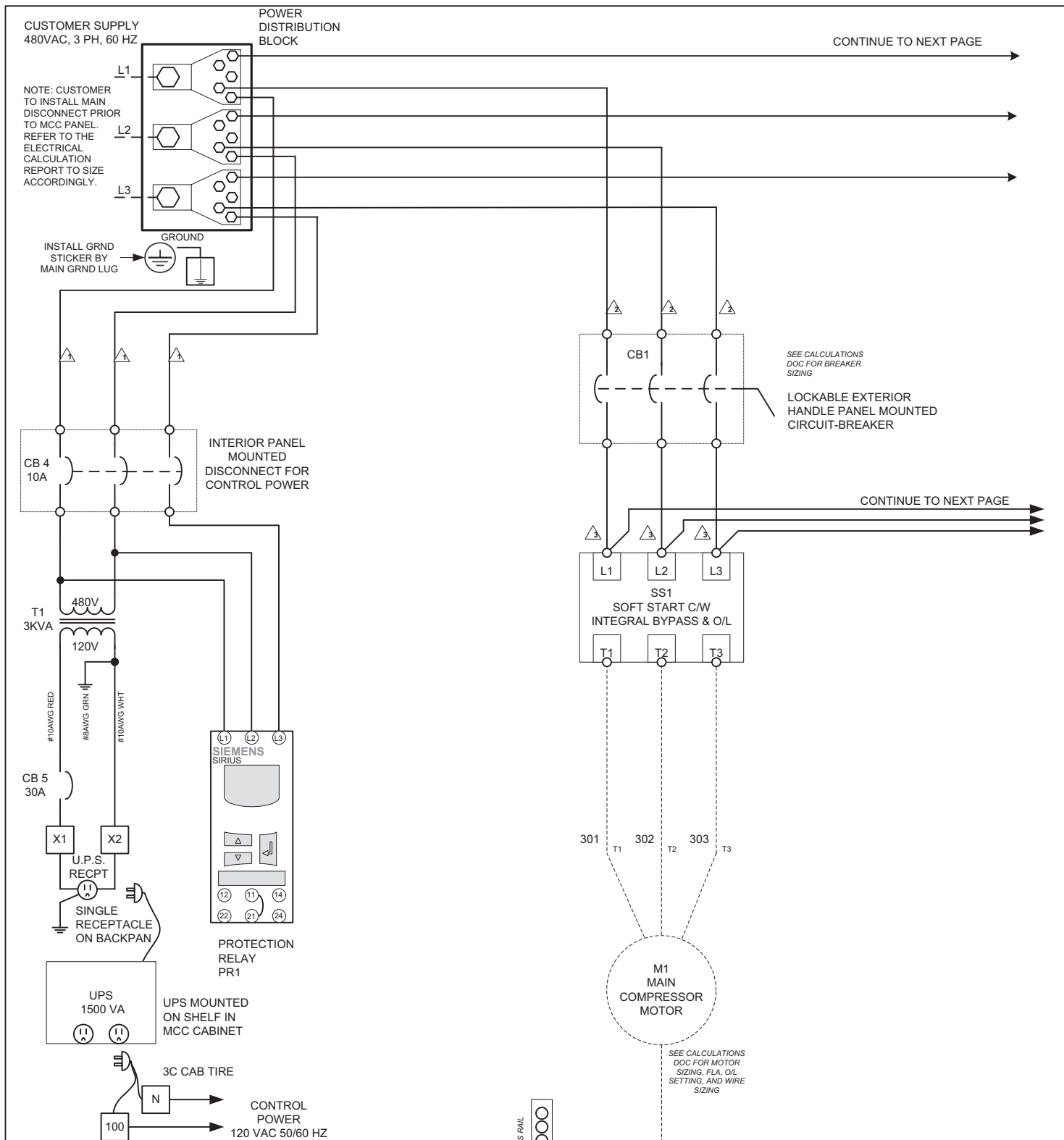
Revision number marked on drawings next to each revision. Indicated by: 

REV.	DESCRIPTION	DATE	BY
A	- Original issue	2011.02.11	KL
B	- Added MCC panel Vent fan	2011.02.28	IB
C	- Drafting corrections, pg.4, pg.10	2011.03.17	KL
D	- AS-BUILT updates	2011.03.30	IB

	IMW Industries Ltd. Chilliwack, BC, Canada	DWG. NO.	450068
		MRP ID	
		REV:	D See Rev Sheet
TITLE:	CONTROL PANEL SCHEMATIC	DATE:	2011.03.30
TYPE:	Electric Drive w/ Skid Electrical Room	SHEET:	1 of 12




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NOTES:

- Dashed lines indicate wiring remote to this panel.
- 143 Indicates internal terminal block & number.
- 24 Indicates external terminal block & number.
- Indicates junction.

WIRE NUMBERS	SIZE	COLOR	TYPE
100	#10 AWG	RED	TEW or Equivalent
N	#10 AWG	WHITE	TEW or Equivalent
TRANS. GROUND	#8 AWG	GREEN	TEW or Equivalent
	#10 AWG	BLACK	TEW or Equivalent
	(SEE CALCS)	BLACK	TEW or Equivalent
	(SEE CALCS)	BLACK	TEW or Equivalent
	(SEE CALCS)	BLACK	TEW or Equivalent
	(SEE CALCS)	BLACK	TEW or Equivalent

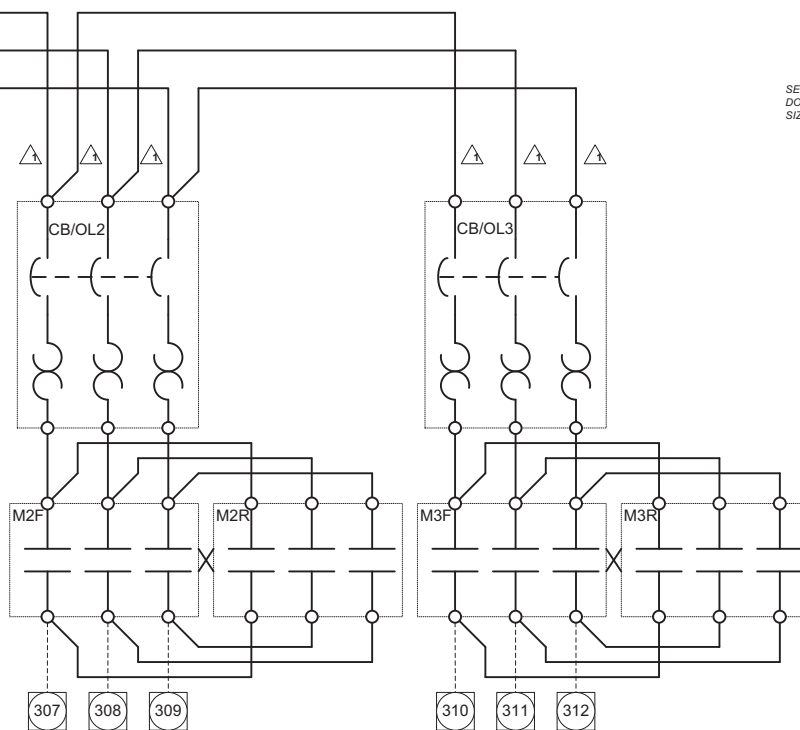
 IMW Industries Ltd. Chilliwack, BC, Canada	DWG. NO. MRP ID	450068
	REV:	D See Rev Sheet
TITLE:	CONTROL PANEL SCHEMATIC	
DATE:	2011.03.30	
TYPE:	Electric Drive w/ Skid Electrical Room	SHEET: 2 of 12



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CONTINUED FROM PDB ON
PREVIOUS PAGE

CONTINUED FROM SOFT
STARTER ON PREVIOUS PAGE



SEE CALCULATIONS DOC FOR MOTOR
SIZING, FLA, OIL SETTING, AND WIRE SIZING

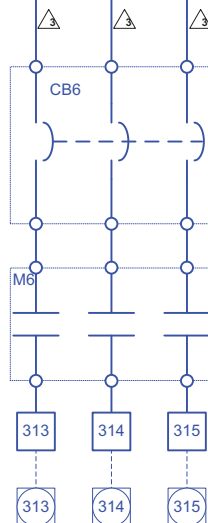
COOLER MOTOR

COOLER / VENT
FAN MOTOR

THIS MOTOR MUST BE
WIRED AS EXPLOSION
PROOF FOR CLASS I DIV 1
LOCATIONS

15A

SEE CALCULATIONS
DOC FOR BREAKER
SIZING




OPTION 20
SPACE HEATER

CONTINUED FROM
PREVIOUS PAGE

NOTES:

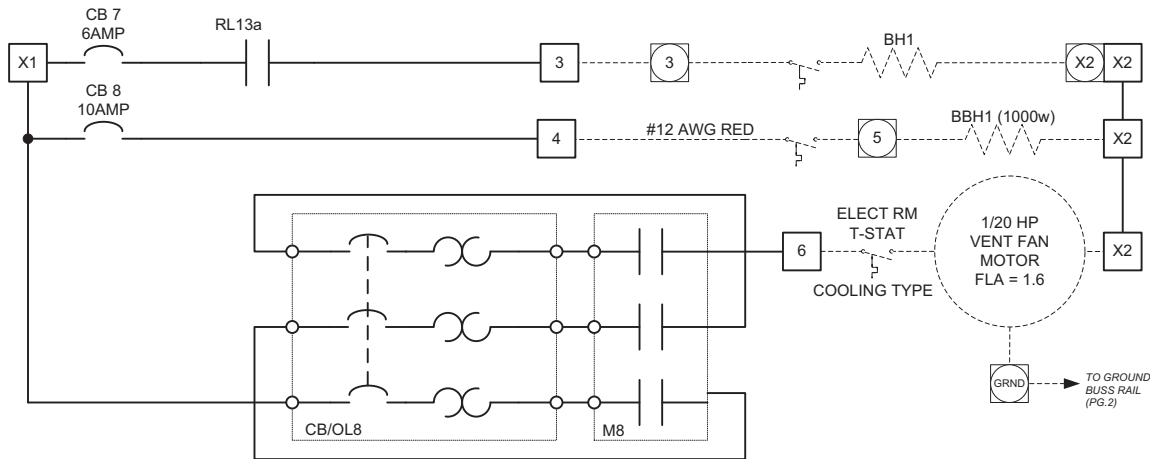
- Dashed lines indicate wiring remote to this panel.
- 143 Indicates internal terminal block & number.
- 124 Indicates external terminal block & number.
- Indicates junction.

WIRE NUMBERS	SIZE	COLOR	TYPE
100	#10 AWG	RED	TEW or Equivalent
N	#10 AWG	WHITE	TEW or Equivalent
TRANS. GROUND	#8 AWG	GREEN	TEW or Equivalent
143	#10 AWG	BLACK	TEW or Equivalent
143	(SEE CALCS)	BLACK	TEW or Equivalent
143	(SEE CALCS)	BLACK	TEW or Equivalent
143	(SEE CALCS)	BLACK	TEW or Equivalent
143	(SEE CALCS)	BLACK	TEW or Equivalent

	IMW Industries Ltd. Chilliwack, BC, Canada	DWG. NO.	450068
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		REV:	D See Rev Sheet
TITLE:	CONTROL PANEL SCHEMATIC	DATE:	2011.03.30
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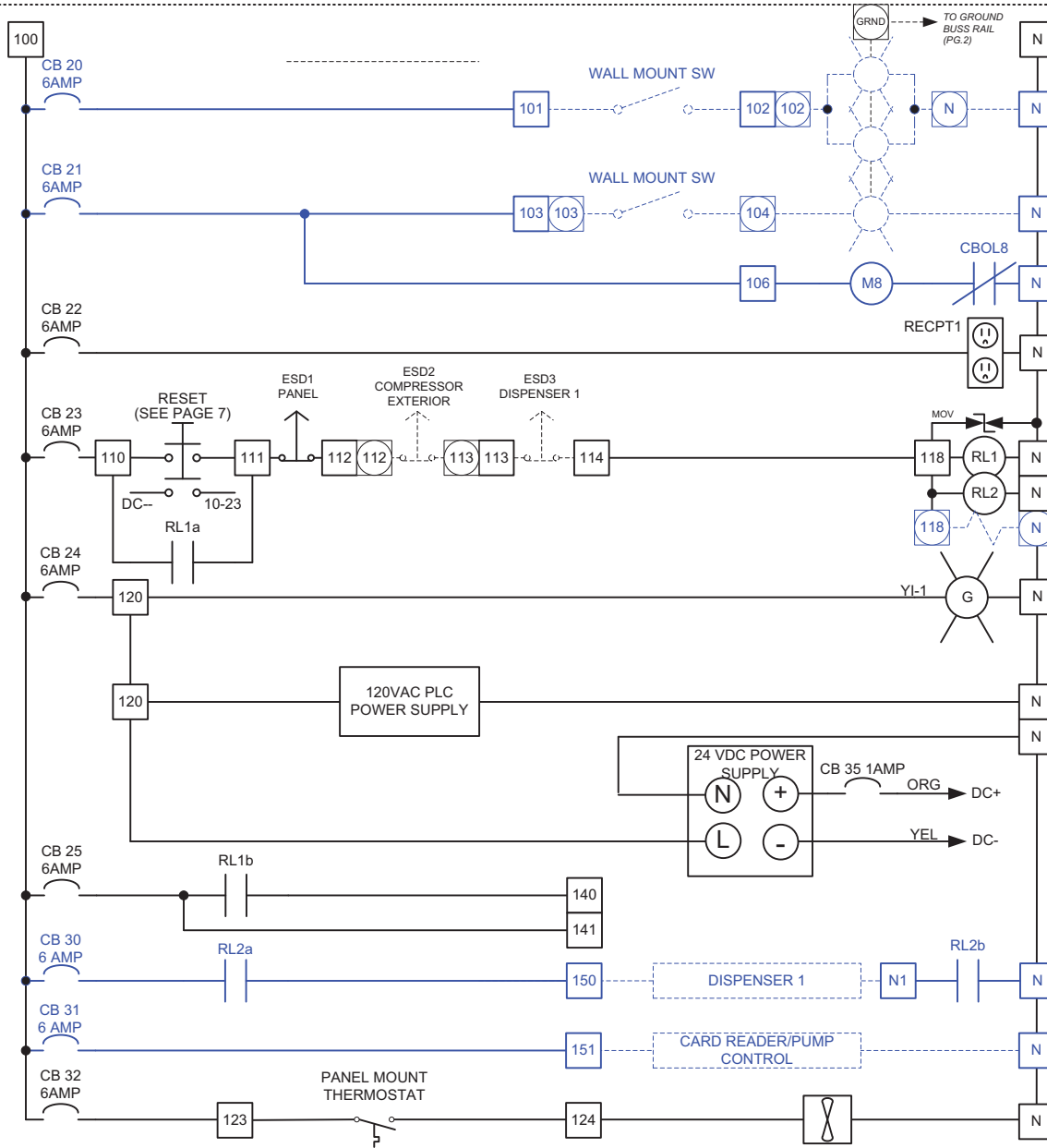
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OPTION 15
BLOCK HEATER
300 WATT (INTERNAL
THERMOSTAT)

SPECIAL OPTION
ELECTRICAL ROOM
BASEBOARD HEATER
1000W TOTAL

ELECTRICAL ROOM
VENT FAN



OPTION # 8
COMPRESSOR ROOM LIGHTING

SPECIAL OPTION
ELECTRICAL ROOM LIGHTING

SPECIAL OPTION
ELECTRICAL ROOM VENT FAN

PANEL RECEPTACLE
500 VA ONLY

EMERGENCY STOP RELAY 1
(ESD)
EMERGENCY STOP RELAY 2
(ESD)

OPTION # 9
ESD SOLENOID(S)
(ENERGIZE TO OPEN)

POWER ON
LAMP

PLC POWER SUPPLY

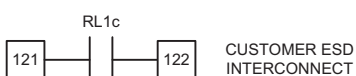
DC POWER SUPPLY
(1.5 AMP 24VDC)


RELAY OUTPUT CARD
OUTPUTS 4-15
(ESD POWERED)
RELAY OUTPUT CARD
OUTPUTS 0-3
(CONTINUOUS POWERED)

OPTION # 11
PROVISION FOR DISPENSER 1

PROVISION FOR FUEL
MANAGEMENT CONTROLLER

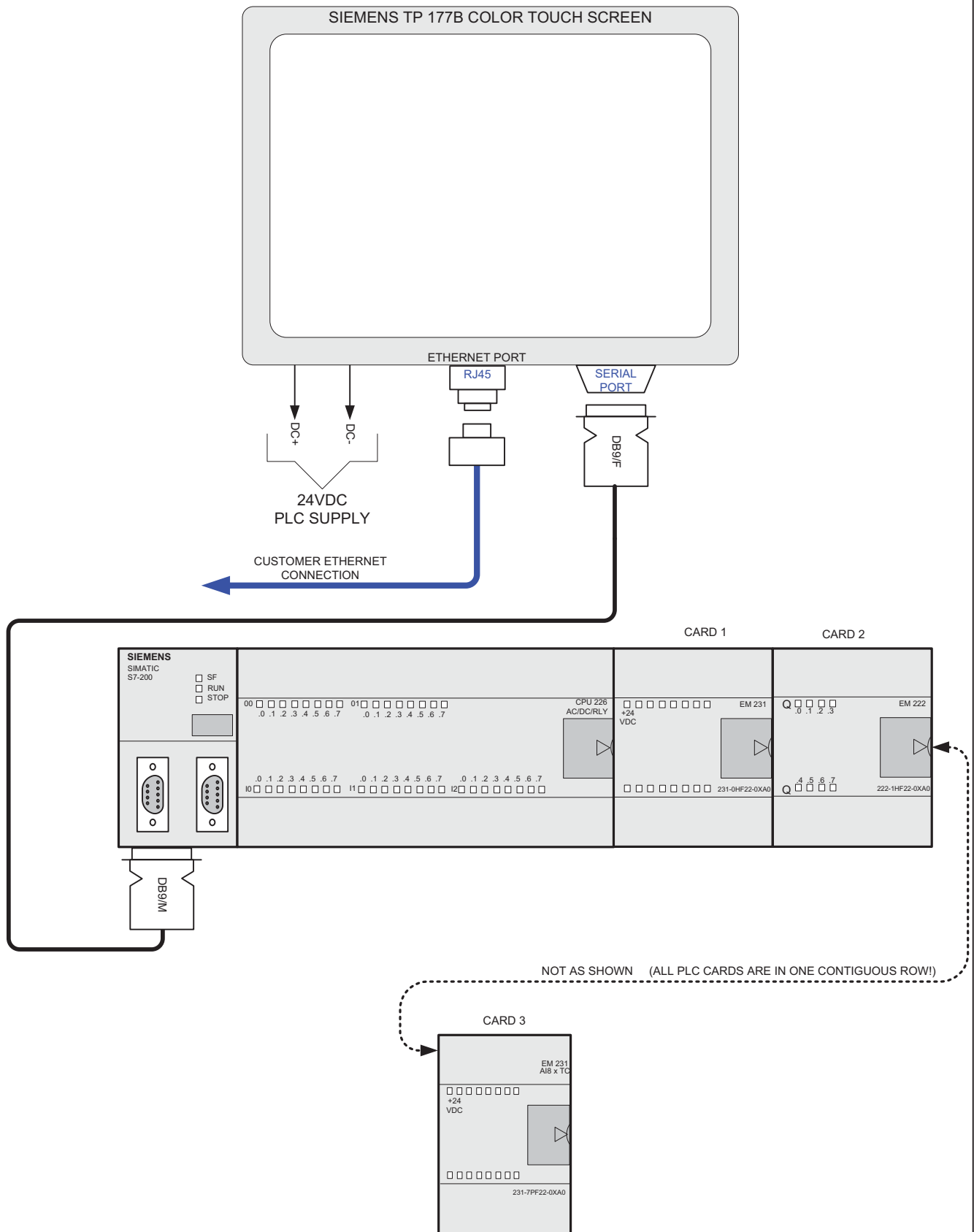
OPTION 22
COOLING/VENTILATION
FAN




	IMW Industries Ltd. Chilliwack, BC, Canada	DWG. NO.	450068
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	IMW Industries Ltd. Chilliwack, BC, Canada	DWG. NO.	450068
		MRP ID	
TITLE: CONTROL PANEL SCHEMATIC		REV: D	See Rev Sheet
TYPE: Electric Drive w/ Skid Electrical Room		DATE: 2011.03.30	
		SHEET:	5 of 12



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SPARE

SPARE

SPARE

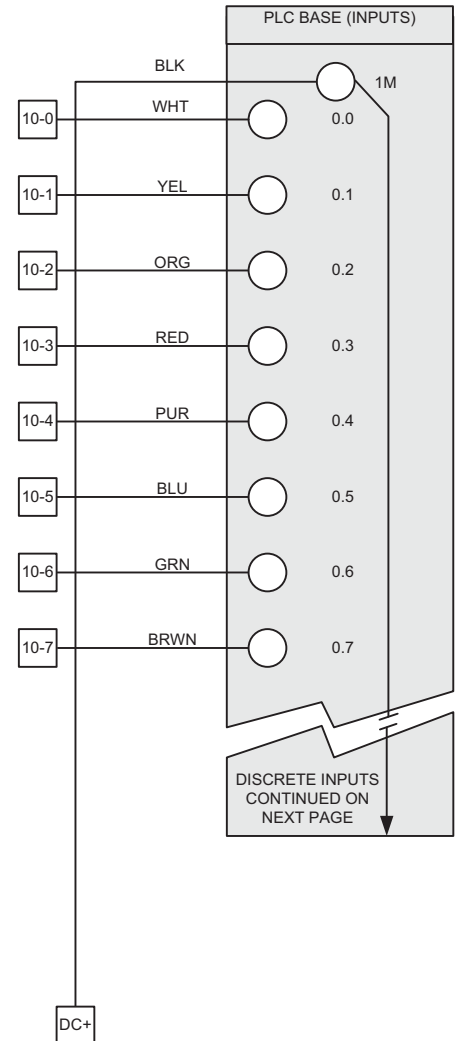
SPARE

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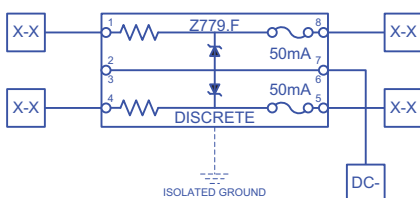
SPARE


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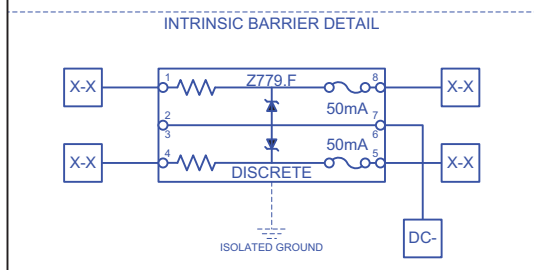
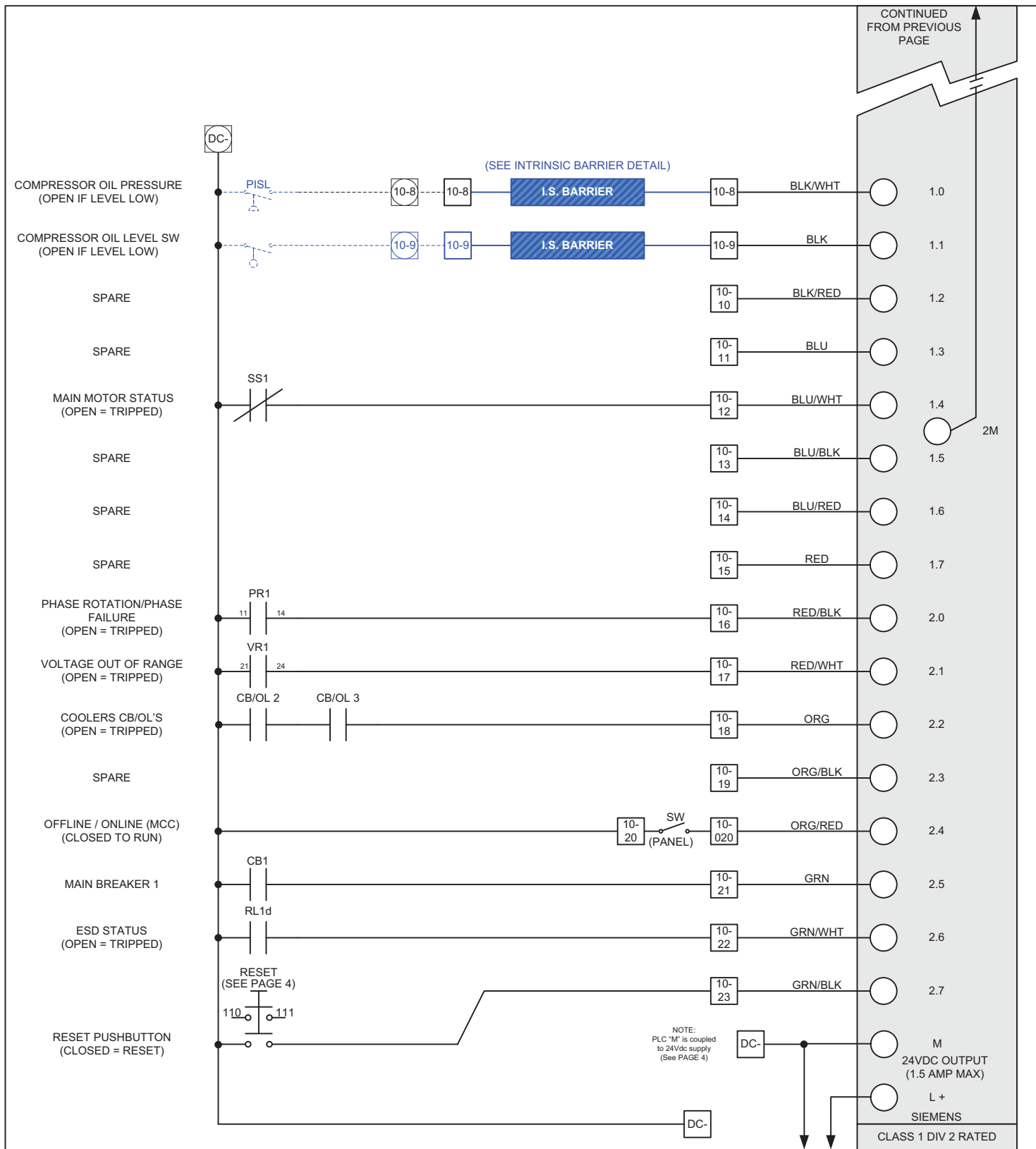
INTRINSIC BARRIER DETAIL




 IMW Industries Ltd. Chilliwack, BC, Canada	DWG. NO. MRP ID	450068
	REV:	D See Rev Sheet
TITLE:	CONTROL PANEL SCHEMATIC	
DATE:	2011.03.30	
TYPE:	Electric Drive w/ Skid Electrical Room	
SHEET:	6 of 12	



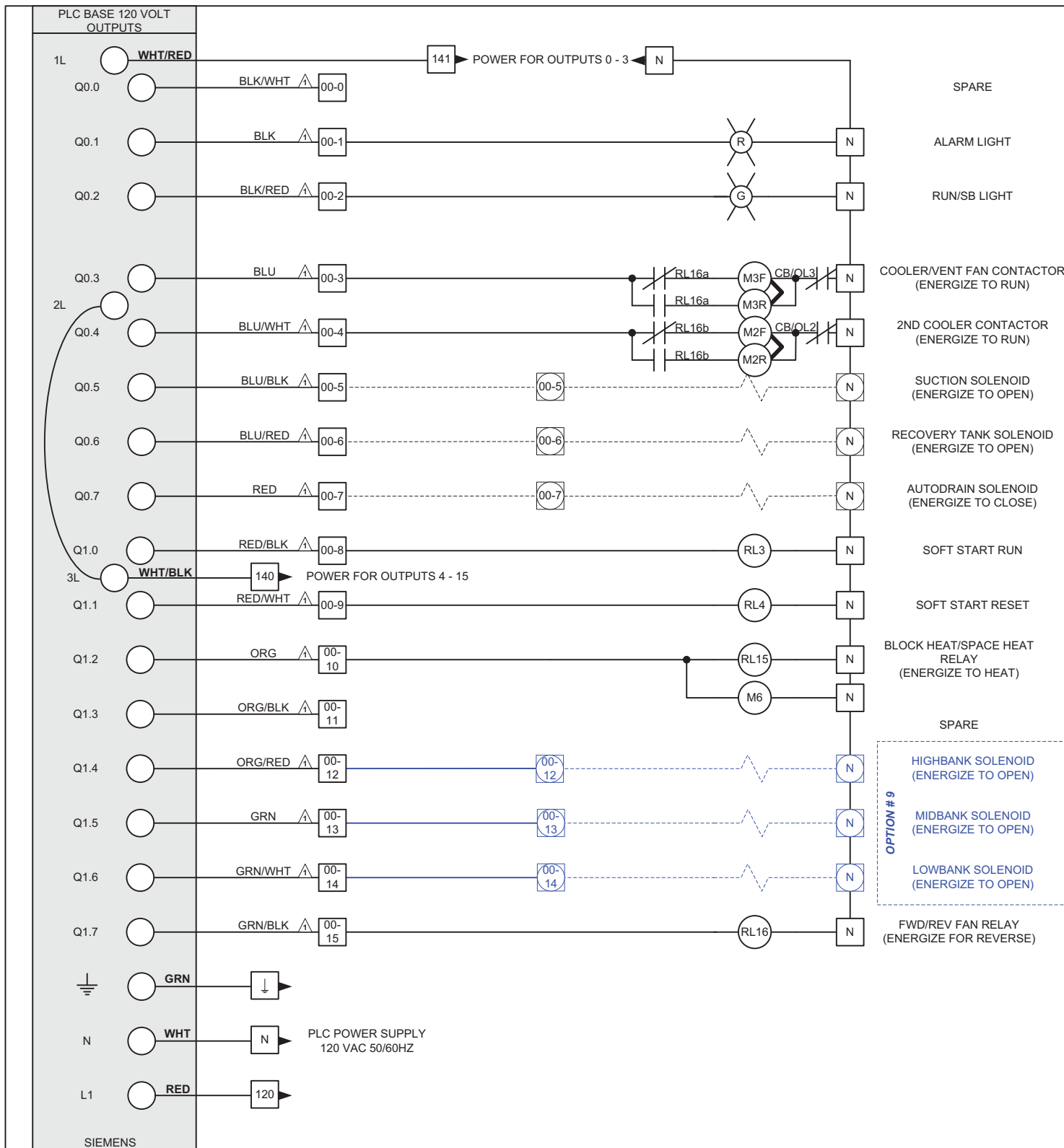
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 IMW Industries Ltd. Chilliwack, BC, Canada	DWG. NO. MRP ID	450068
	REV:	D See Rev Sheet
TITLE:	CONTROL PANEL SCHEMATIC	
DATE:	2011.03.30	
TYPE:	Electric Drive w/ Skid Electrical Room	
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	IMW Industries Ltd. Chilliwack, BC, Canada	DWG. NO.	450068
		MRP ID	
		REV:	D See Rev Sheet
TITLE:	CONTROL PANEL SCHEMATIC	DATE:	2011.03.30
TYPE:	Electric Drive w/ Skid Electrical Room	SHEET:	8 of 12

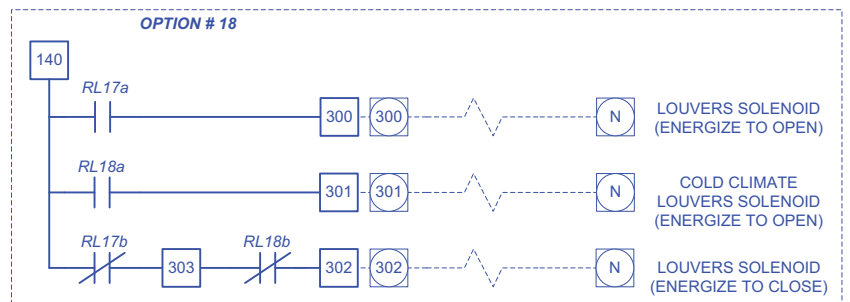
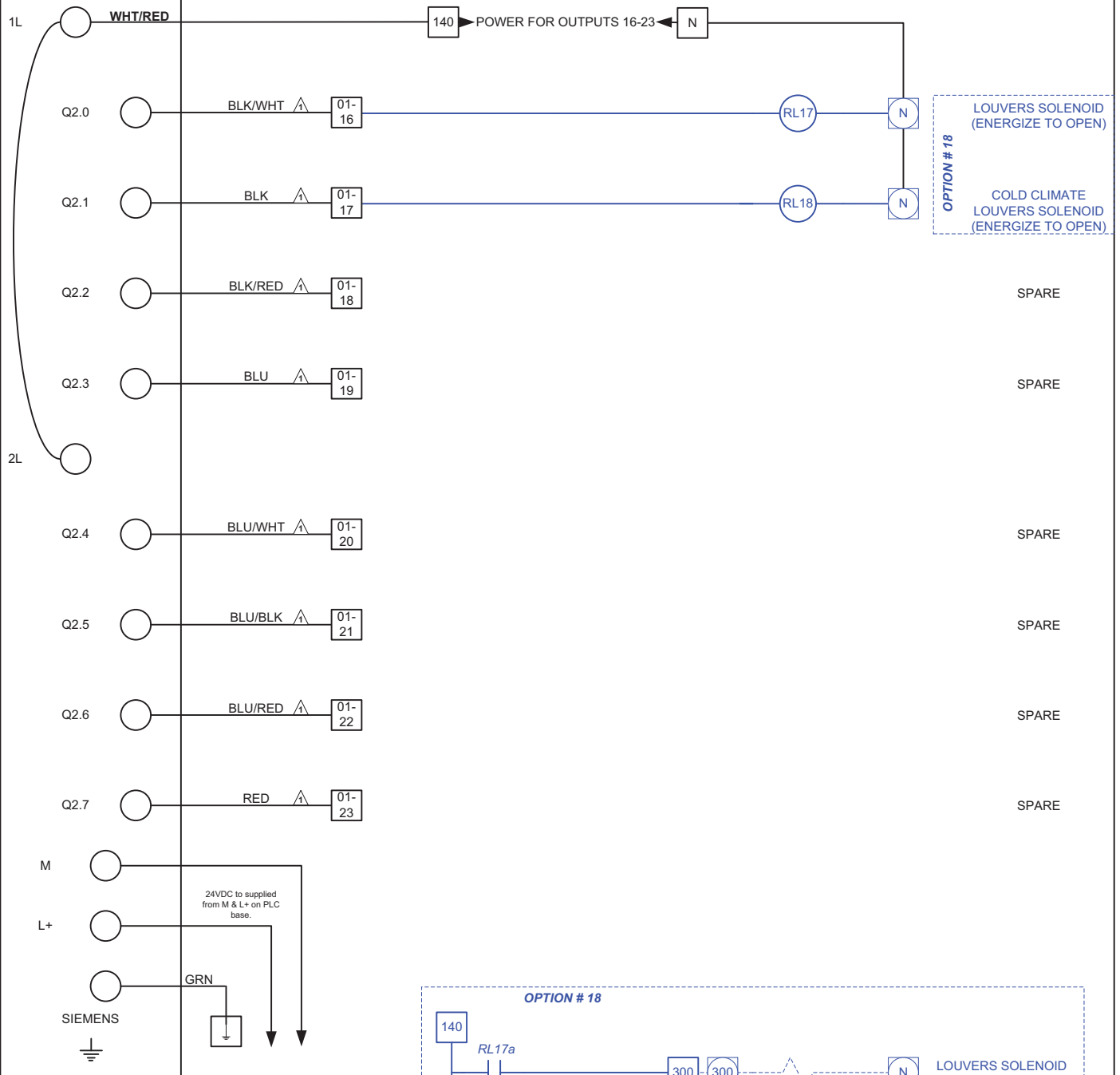
△ ALL OUTPUTS SHALL HAVE MOV INSTALLED (not shown)



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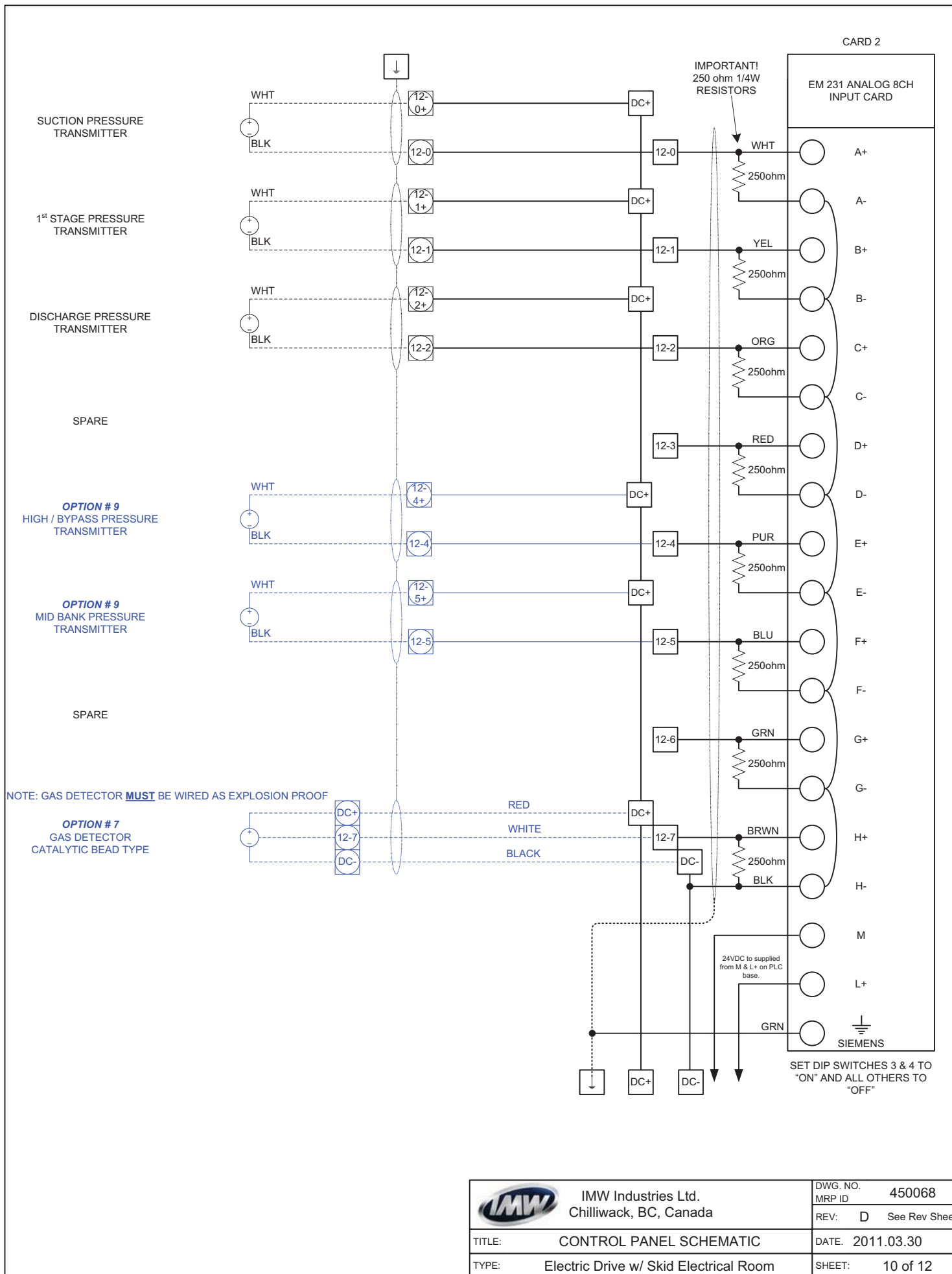
CARD 1

EM 222 8CH
RELAY OUTPUT CARD



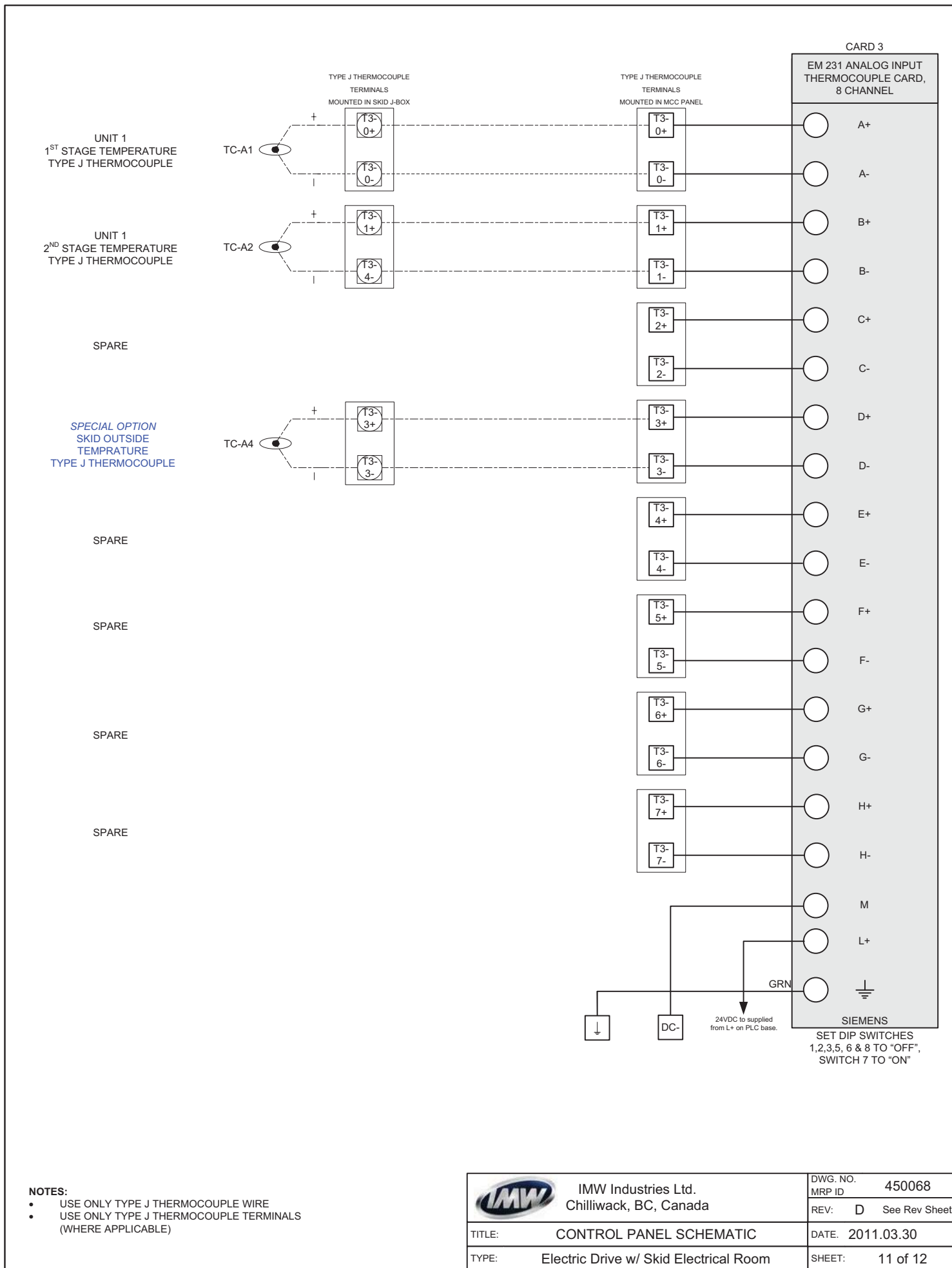


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IMW Industries Ltd.
Chilliwack, BC, Canada

DWG. NO. 450068
MRP ID
REV: D See Rev Sheet

TITLE: CONTROL PANEL SCHEMATIC

DATE: 2011.03.30

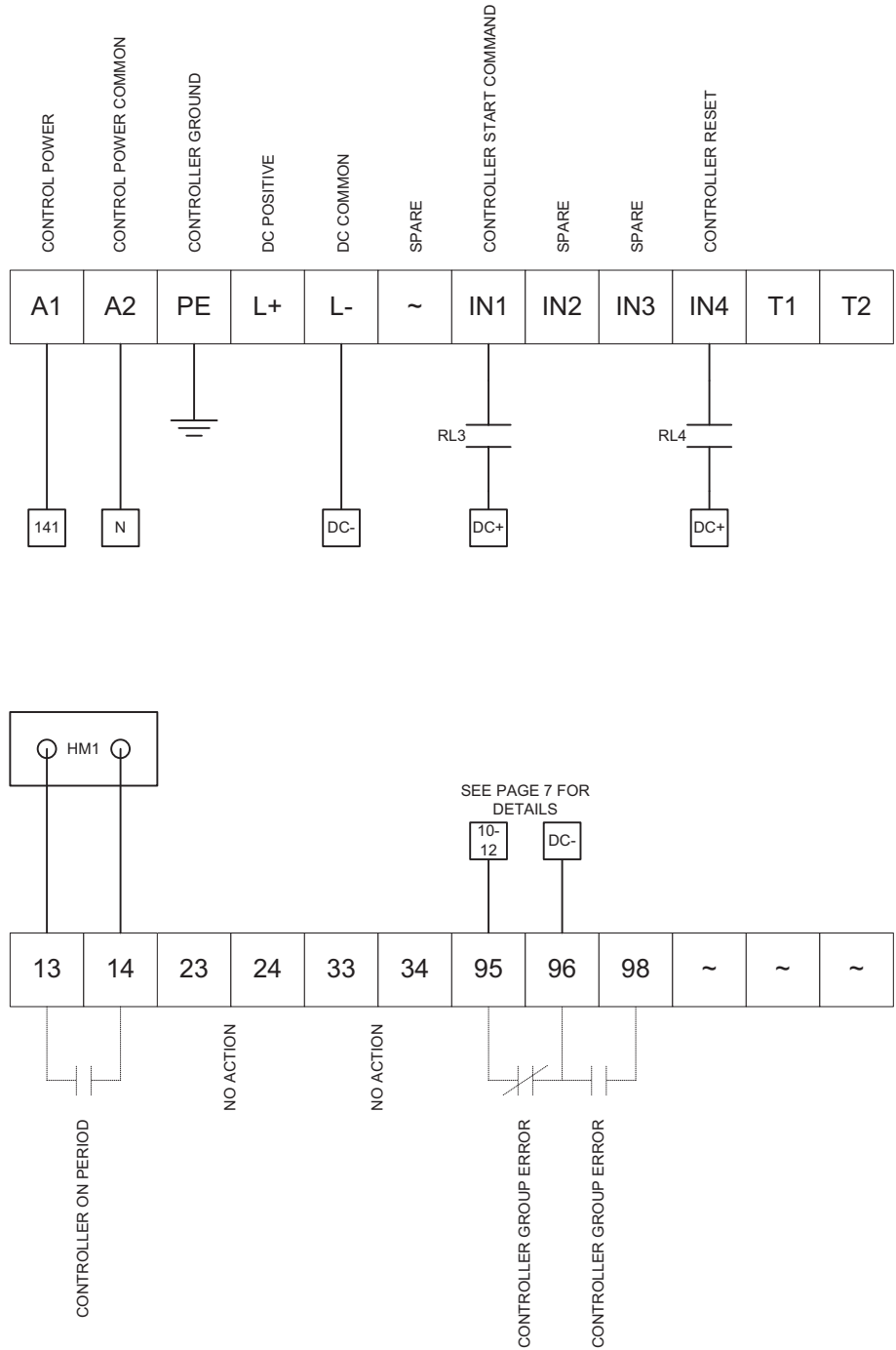
TYPE: Electric Drive w/ Skid Electrical Room

SHEET: 11 of 12



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SOFT START



Note:
Motor rotation is factory set. If soft starter detects incorrect phase rotation the incoming service supply must be reversed. All motors will turn in the correct direction if phase rotation is correct.




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DRAWING REVISION HISTORY

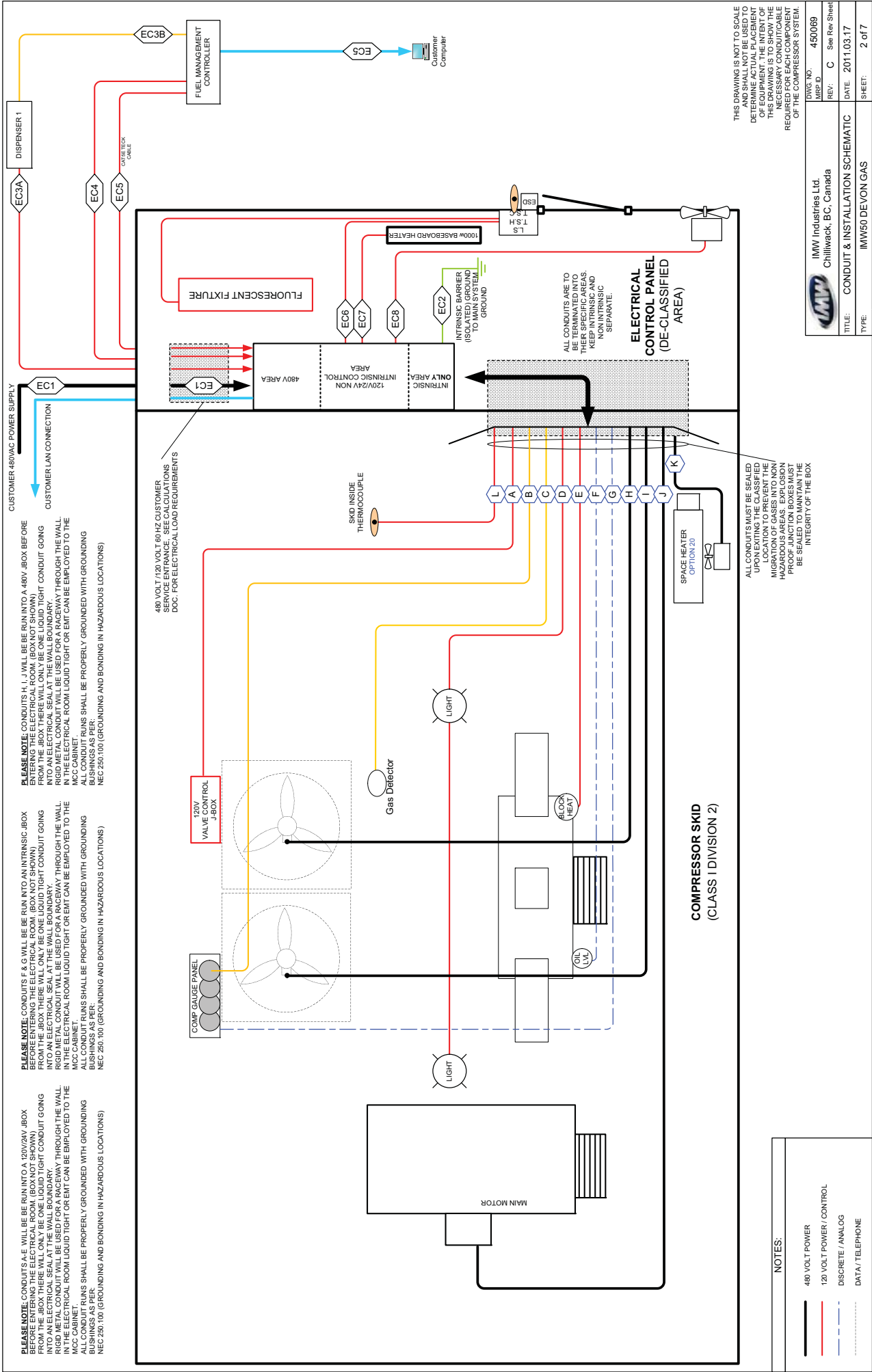
Revision number marked on drawings next to each revision. Indicated by: A

REV.	DESCRIPTION	DATE	BY
A	- Original issue	2011.02.11	IB
B	- Added inside skid thermocouple	2011.02.28	IB
C	- Removed low bank pt, pg.5 & corrected description of skid thermocouple, pg.7	2011.03.17	KL

	IMW Industries Ltd. Chilliwack, BC, Canada	DWG. NO.	450069
		MRP ID	
TITLE: CONDUIT & INSTALLATION SCHEMATIC		REV:	C See Rev Sheet
TYPE: IMW50 DEVON GAS		DATE:	2011.03.17
		SHEET:	1 of 7



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CONDUIT # EC1:**MAIN POWER FEED**

CUSTOMER SUPPLIED

WIRING METHOD: AS PER LOCAL CODE

480 VOLT, 3 PHASE, 60HZ, (WITH FRAME GROUND WIRE)

CONDUIT # EC2:**INTRINSIC BARRIER GROUND**

CUSTOMER SUPPLIED

WIRING METHOD: AS PER LOCAL CODE

RECOMMENDED: #10 AWG INSULATED STRANDED WIRE (GRN/YEL) 1kV

LAN CONNECTION

SUPPLIER: CUSTOMER

WIRING METHOD: 4 Twisted pair Category 5 (min) or approved equal

RECOMMENDED: DEDICATED LINE WITH FIXED IP ADDRESS FOR REMOTE MONITORING. CONTACT IMW FOR SETUP INSTRUCTIONS.

CONDUIT # EC3A:**DISPENSER # 1 - POWER / ESD**


WIRING METHOD: AS PER LOCAL CODE

RECOMMENDED: 6 Conductor #14awg teck cable (Sealed within 18" of dispenser junction box).

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
N	Neutral	White	T90 Stranded	14 awg
150	Dispenser 1 Power	Black	T90 Stranded	14 awg
113	Dispenser 1 ESD Pushbutton	Black	T90 Stranded	14 awg
114	Dispenser 1 ESD Pushbutton	Black	T90 Stranded	14 awg

CONDUIT #EC3B:**PULSE & AUTHORIZE FROM DISPENSER 1**WIRING METHOD: 4 Pair twisted shielded teck cable or approved equal.
(sealed withing 18" of dispenser junction box).

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
D1a(#19)	Disp 1a Volume wire #19	Black	Shielded Pair 1	18 AWG
D1a(#18)	Disp 1a Pulse wire #18	White	Shielded Pair 1	18 AWG
D1a(#14)	Dispenser 1a Authorization signal	Black	Shielded Pair 2	18 AWG
D1a(#1)	120VAC	White	Shielded Pair 2	18 AWG
D1b(#19)	Disp 1b Volume wire #19	Black	Shielded Pair 3	18 AWG
D1b(#18)	Disp 1b Pulse wire #18	White	Shielded Pair 3	18 AWG
D1b(#14)	Dispenser 1b Authorization signal	Black	Shielded Pair 4	18 AWG
D1b(#1)	120VAC	White	Shielded Pair 4	18 AWG

	IMW Industries Ltd. Chilliwack, BC, Canada	DWG. NO.	450069
		MRP ID	
REV: C See Rev Sheet			
TITLE: CONDUIT & INSTALLATION SCHEMATIC			
DATE: 2011.03.17			
TYPE: IMW50 DEVON GAS		SHEET:	3 of 7



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CONDUIT # EC4:**FUEL MANAGEMENT CONTROLLER POWER**

WIRING METHOD: AS PER LOCAL CODE
RECOMMENDED: 6 Conductor #14awg teck cable (Sealed within 18" of dispenser junction box).

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
N	Neutral	White	T90 Stranded	14 awg
151	Fuel Management controller pwr	Black	T90 Stranded	14 awg
Spares				

CONDUIT # EC5:**FUEL MANAGEMENT CONTROL**

WIRING METHOD: 4 Twisted pair (UTP CAT5 TECK)

CONDUIT # EC6:**(ELEC ROOM) LIGHT/HEAT/ESD CONTROLS**

WIRING METHOD: 1" EMT Conduit

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
4	Baseboard heater	Red	TEW Stranded	12 awg
5	Baseboard heater supply	Red	TEW Stranded	14 awg
X2	Neutral	White	TEW Stranded	12 awg
112	ESD2 Compressor	Red	TEW Stranded	16 awg
113	ESD2 Compressor	Red	TEW Stranded	16 awg
103	Elect room lighting power	Red	TEW Stranded	16 awg
104	Elect room lighting switch leg	Red	TEW Stranded	16 awg
105	Elect room cooling fan supply	Red	TEW Stranded	16 awg
106	Elect room cooling fan	Red	TEW Stranded	16 awg
N	Neutral	White	TEW Stranded	14 awg
T3-3+	External Ambient Temp. TC	White	Type J Thermocouple	18 awg
T3-3-	External Ambient Temp. TC	Red	Type J Thermocouple	18 awg

CONDUIT # EC7:**(ELEC ROOM) BASEBOARD HEATER**


WIRING METHOD: ½" EMT Conduit

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
5	1000W Baseboard heater	Red	TEW Stranded	14 awg
X2	Neutral	White	TEW Stranded	14 awg

CONDUIT # EC8:**(ELEC ROOM) VENT FAN**

WIRING METHOD: ½" EMT Conduit

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
6	Vent Fan	Red	TEW Stranded	14 awg
X2	Neutral	White	TEW Stranded	14 awg

	IMW Industries Ltd. Chilliwack, BC, Canada	DWG. NO.	450069
		MRP ID	
TITLE: CONDUIT & INSTALLATION SCHEMATIC		REV: C	See Rev Sheet
TYPE: IMW50 DEVON GAS		DATE: 2011.03.17	
		SHEET: 4 of 7	



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CONDUIT # A: (120 VOLT) SOLENOIDS

WIRING METHOD: 15 Conductor #14awg Teck90

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
00-5	Suction Solenoid	Black	T90 Stranded	14 awg
00-6	Recovery Tank Solenoid	Black	T90 Stranded	14 awg
00-7	Autodrain Solenoid	Black	T90 Stranded	14 awg
300	Louvers Solenoid	Black	T90 Stranded	14 awg
301	Cold Climate Louvers Solenoid	Black	T90 Stranded	14 awg
302	Louvers closing Solenoid	Black	T90 Stranded	14 awg
00-12	High Bank Solenoid	Black	T90 Stranded	14 awg
00-13	Mid Bank Solenoid	Black	T90 Stranded	14 awg
00-14	Low Bank Solenoid	Black	T90 Stranded	14 awg
N	Neutral	Black	T90 Stranded	14 awg
118	ESD Solenoid	Black	T90 Stranded	14 awg

CONDUIT # B: COMPRESSOR GAUGE PANEL

WIRING METHOD: ¾" Liquid tight Flex

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
12-0+	Suction Pressure	White	Shielded pair 1	18 awg
12-0-	Suction Pressure	Black	Shielded pair 1	18 awg
12-1+	1 st Stage Pressure Transmitter	White	Shielded pair 2	18 awg
12-1-	1 st Stage Pressure Transmitter	Black	Shielded pair 2	18 awg
12-2+	Discharge Pressure	White	Shielded pair 3	18 awg
12-2-	Discharge Pressure	Black	Shielded pair 3	18 awg
12-4+	High/Bypass Pressure	White	Shielded pair 4	18 awg
12-4-	High/Bypass Pressure	Black	Shielded pair 4	18 awg
12-5+	Mid Bank Pressure	White	Shielded pair 5	18 awg
12-5-	Mid Bank Pressure	Black	Shielded pair 5	18 awg

CONDUIT # C: (ANALOG) GAS DETECTOR


WIRING METHOD: 1 Triad #18 Shielded Teck Cable

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
DC+	DC Positive	Red	Shielded Triad 1	18 awg
12-7	Gas Detector Signal	White	Shielded Triad 1	18 awg
DC-	DC Common	Black	Shielded Triad 1	18 awg

CONDUIT # D: (120 VOLT) SKID LIGHTING

WIRING METHOD: 3 Conductor #14awg Teck90

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
102	Skid Light	Red	T90 Stranded	14 awg
N	Neutral	White	T90 Stranded	14 awg
SP	Spare	Black	T90 Stranded	14 awg

	IMW Industries Ltd. Chilliwack, BC, Canada	DWG. NO.	450069
		MRP ID	
		REV: C	See Rev Sheet
TITLE:	CONDUIT & INSTALLATION SCHEMATIC	DATE:	2011.03.17
TYPE:	IMW50 DEVON GAS	SHEET:	5 of 7



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CONDUIT # E: (120 VOLT) BLOCK OIL HEATER (OPTION 15)

WIRING METHOD: 3 Conductor #14awg Teck90

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
3	Block Heat Power	Red	T90 Stranded	14 awg
X2	Block Heat neutral	Blue	T90 Stranded	14 awg
SP1	spare	Black	T90 Stranded	14 awg

CONDUIT # F: (INTRINSIC) OIL LEVEL SWITCH (OPTION 16)

WIRING METHOD: 3/8" Liquid tight

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
DC-	DC common	Yellow	TEW Stranded	16 awg
10-9	Oil level switch	Blue	TEW Stranded	16 awg

CONDUIT # G: COMPRESSOR GAUGE PANEL (INTRINSIC)

WIRING METHOD: 3/8" Liquid tight

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
DC-	DC Common	Yellow	TEW Stranded	16 awg
10-8	Compressor Oil Pressure	Blue	TEW Stranded	16 awg

CONDUIT # H: 480 VOLT COOLER MOTOR

WIRING METHOD: 3 Conductor #14 awg Teck 90

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
307	Cooler Motor	Red	T90 Stranded	14 awg
308	Cooler Motor	Black	T90 Stranded	14 awg
309	Cooler Motor	Blue	T90 Stranded	14 awg

CONDUIT # I: 480 VOLT COOLER /VENT FAN MOTOR


WIRING METHOD: 3 Conductor #14 awg Teck 90

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
310	Cooler Motor	Red	T90 Stranded	14 awg
311	Cooler Motor	Black	T90 Stranded	14 awg
312	Cooler Motor	Blue	T90 Stranded	14 awg

CONDUIT # K: (480 VOLT) SPACE HEATER

WIRING METHOD: 3 Conductor #12 awg Teck 90 Cable

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
313	Space heater T1	Black	T90 Stranded	12 awg
314	Space heater T2	Black	T90 Stranded	12 awg
315	Space heater T3	Black	T90 Stranded	12 awg

	IMW Industries Ltd. Chilliwack, BC, Canada	DWG. NO.	450069
		MRP ID	
		REV:	C See Rev Sheet
TITLE: CONDUIT & INSTALLATION SCHEMATIC		DATE:	2011.03.17
TYPE: IMW50 DEVON GAS		SHEET:	6 of 7



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CONDUIT # J: 480 VOLT COMPRESSOR MOTOR


WIRING METHOD: See calculations document for conductor size

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
301	Compressor Motor T1	Black	T90 Stranded	See Calcs
302	Compressor Motor T2	Black	T90 Stranded	See Calcs
303	Compressor Motor T3	Black	T90 Stranded	See Calcs

CONDUIT # L: INSIDE SKID THERMOCOUPLE

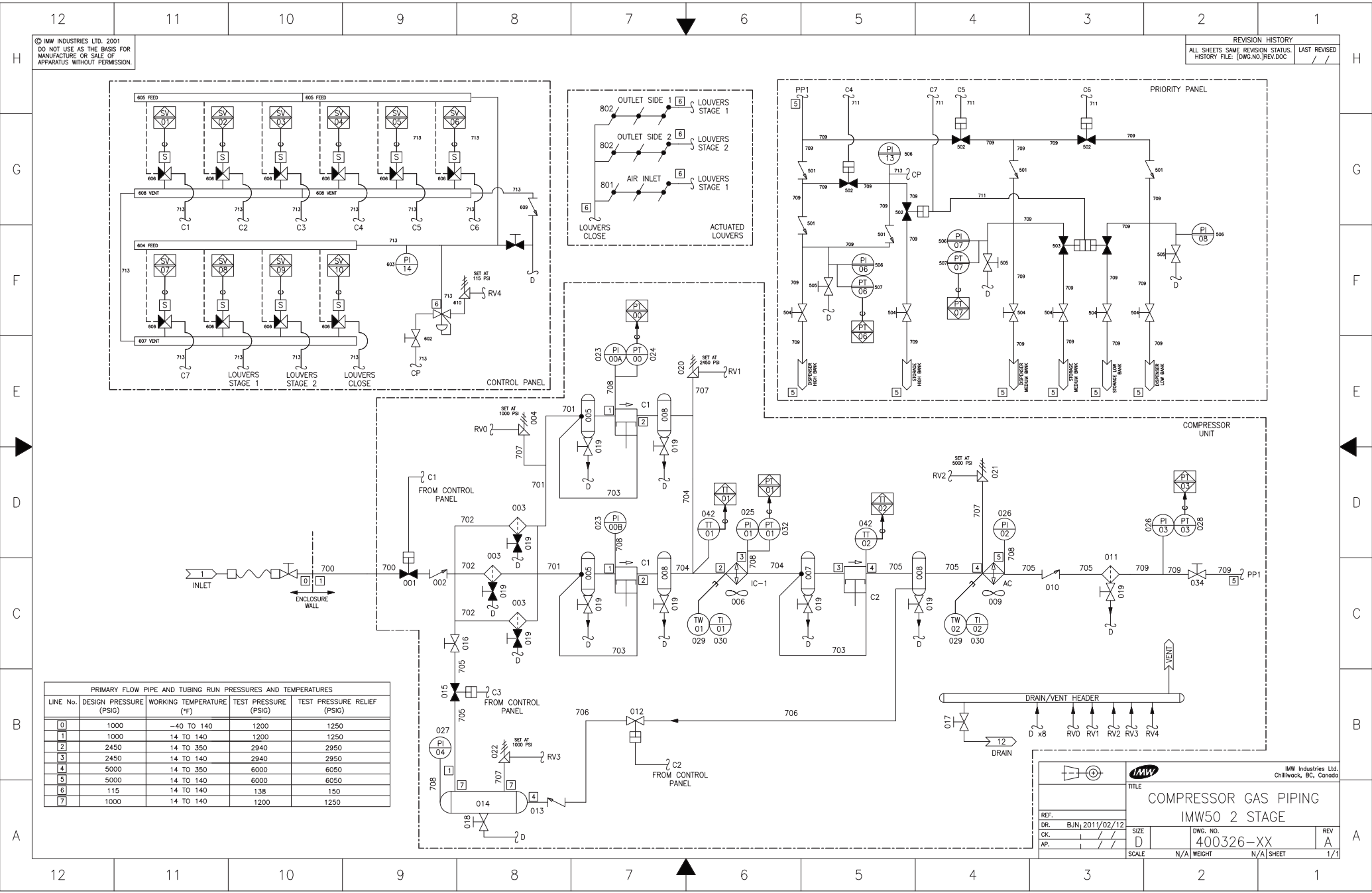
WIRING METHOD: 1 Triad #18 Shielded Teck Cable

WIRE #	DESCRIPTION	COLOR	TYPE	SIZE
T3-4+	Internal Skid Temp. TC	White	Type J Thermocouple	18 awg
T3-4-	Internal Skid Temp. TC	Red	Type J Thermocouple	18 awg

	IMW Industries Ltd. Chilliwack, BC, Canada	DWG. NO.	450069
		MRP ID	
		REV:	C See Rev Sheet
TITLE:	CONDUIT & INSTALLATION SCHEMATIC	DATE:	2011.03.17
TYPE:	IMW50 DEVON GAS	SHEET:	7 of 7



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REVISION HISTORY
ALL SHEETS SAME REVISION STATUS. LAST REVISED
HISTORY FILE: [DWG.NO.]REV.DOC

PRIMARY FLOW PIPE AND TUBING RUN PRESSURES AND TEMPERATURES				
LINE No.	DESIGN PRESSURE (PSIG)	WORKING TEMPERATURE (°F)	TEST PRESSURE (PSIG)	TEST PRESSURE RELIEF (PSIG)
0	1000	-40 TO 140	1200	1250
1	1000	14 TO 140	1200	1250
2	2450	14 TO 350	2940	2950
3	2450	14 TO 140	2940	2950
4	5000	14 TO 350	6000	6050
5	5000	14 TO 140	6000	6050
6	115	14 TO 140	138	150
7	1000	14 TO 140	1200	1250



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Parts and Components of Engineering Master

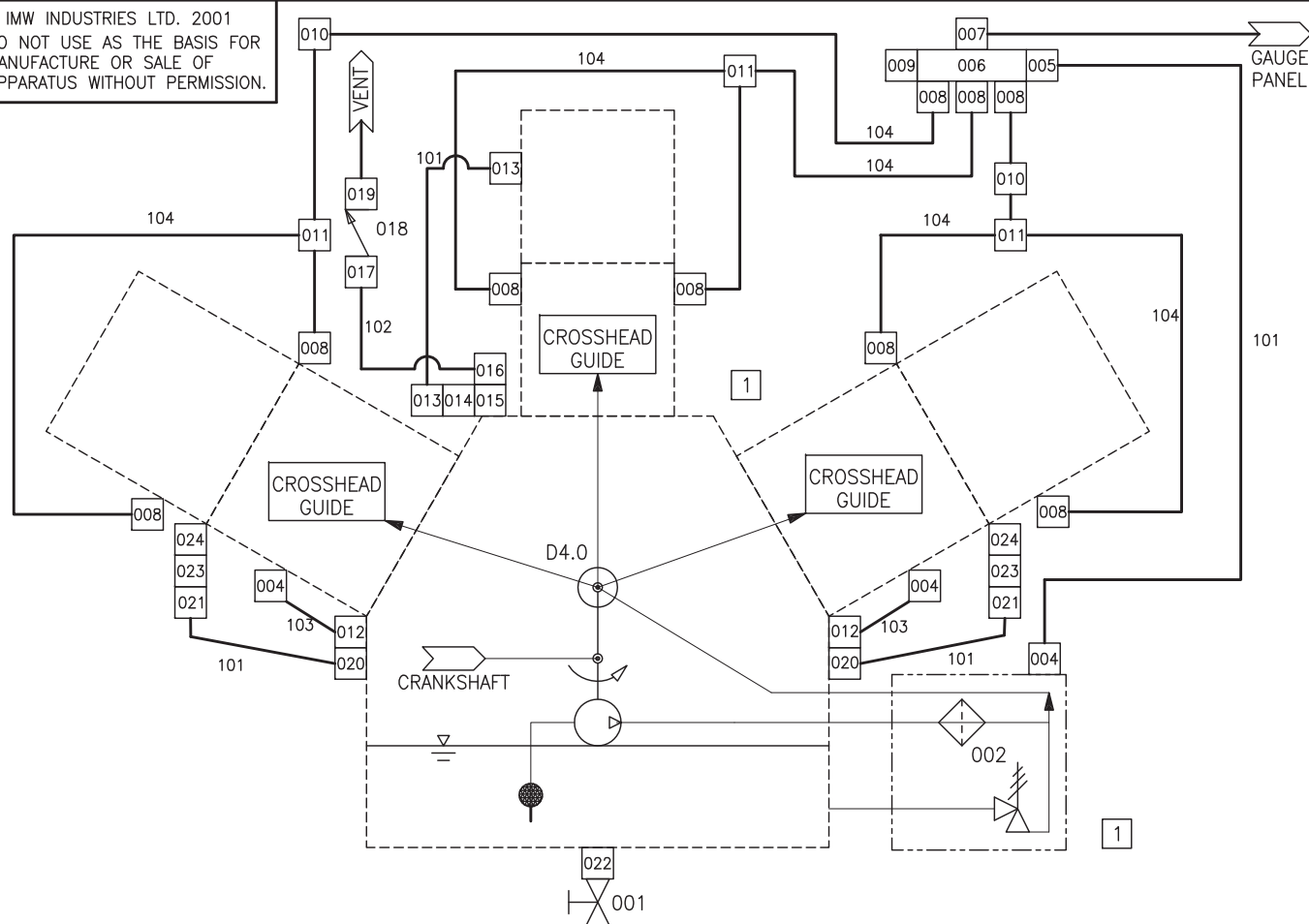
WorkOrder/Eng. Master: 400326-01

Ref	Part ID	Description	QTY per Asm	QTY per W/O	Sub W/O
-----	.	PIPING/ TUBING	1.00	1.00	
700	..311967	PIPE SA-106 GR.B 1.5NPS X SCH80	1.00	1.00	
701	..304192	TUBE CS SA-179 1.250 X 0.120	1.00	1.00	
702	..303758	TUBE SS SA-213 T316 0.750 X 0.095	1.00	1.00	
703	..312144	TUBE SS SA-213 T316 1.000 X 0.095	1.00	1.00	
704	..312144	TUBE SS SA-213 T316 1.000 X 0.095	1.00	1.00	
705	..312898	TUBE SS SA-213 T316 0.750 X 0.109	1.00	1.00	
706	..303748	TUBE SS SA-213 T316 0.375 X 0.049	1.00	1.00	
707	..312898	TUBE SS SA-213 T316 0.750 X 0.109	1.00	1.00	
708	..319332	TUBE SS SA-213 T316 0.125 X 0.028	1.00	1.00	
709	..304320	TUBE SS SA-213 T316 0.500 X 0.065	1.00	1.00	
711	..310734	HOSE RUBBER DOUBLE BRAID 0.250	1.00	1.00	
713	..303747	TUBE SS SA-213 T316/316L 0.250 X 0.035	1.00	1.00	
-----	.	PRIORITY PANEL	1.00	1.00	
501	..307014	VALVE CHECK SS 4400 0.500FNPT @6000PSI	5.00	5.00	
502	..309139	VALVE BALL SS B8L 2WAY 0.500T W/ACT	4.00	4.00	
503	..309140	VALVE BALL SS B8L 2WAY 0.500T W/D.ACT	1.00	1.00	
504	..324158	VALVE BALL SS 2WAY 0.500NPT	6.00	6.00	
505	..332207	VALVE NEEDLE CS 0.250MNPT - 0.250FNPT	4.00	4.00	
506	..320730	GAUGE PRES 2.5IN DIAL 414BAR/6000PSIG	4.00	4.00	
507	..319942	TRANSMITTER PRES 0-6000 PSIG 0.250MNPT	2.00	2.00	
-----	.	CONTROL PANEL	1.00	1.00	
601	..332207	VALVE NEEDLE CS 0.250MNPT - 0.250FNPT	2.00	2.00	
602	..310533	REGULATOR PILOT 0.250FNPT 6000PSIG	1.00	1.00	
603	..322455	GAUGE PRES 2.5IN DIAL 21 BAR/ 300 PSIG	1.00	1.00	
604	..303760	MANIFOLD SOL 4BANK 0.125ORFICE 0.250FNPT	1.00	1.00	
605	..308069	MANIFOLD SOL 3BANK 0.125ORFICE 0.250FNPT	2.00	2.00	
606	..307063	VALVE SOL 0312 3WAY 120V-50/60HZ 115PSI	10.00	10.00	
607	..206981	SOLENOID EXHAUST SQ MANIFOLD 4SOL	1.00	1.00	
608	..206982	SOLENOID EXHAUST SQ MANIFOLD 3SOL	2.00	2.00	
609	..307219	VALVE CHECK SS C4L 0.250T@6000PSIG	1.00	1.00	
610	..331877	VALVE RELIEF 0.75MNPT-1.00FNPT 115 PSI	1.00	1.00	
-----	.	LOUVERS	1.00	1.00	
801	..329882	CYLINDER AIR BIMBA P SERIES 313-DXP DA	1.00	1.00	
802	..332559	CYLINDER AIR BIMBA DOUBLE ACT P SERIES	2.00	2.00	
001	..319484	VALVE BALL CS 1.500FNPT W/ACT 1500PSIG	1.00	1.00	

<i>Ref</i>	<i>Part ID</i>	<i>Description</i>	<i>QTY per Asm</i>	<i>QTY per W/O</i>	<i>Sub W/O</i>
002	.333842	VALVE CHECK 1.500FNPT @ 1000PSI	1.00	1.00	
003	.202579-00	FILTER COALESCING CF-5500-5-CS W/ELEM	3.00	3.00	
004	.332533	VALVE RELIEF 0.75MNPT-1.00FNPT 1000 PSI	1.00	1.00	
005	.204097	BOTTLE SCRUBBER 1200PSIG 1.5x1.25-0.75BP	2.00	2.00	
006	.206051	COOLER SECTION 4P-12T 24N 2500PSI	1.00	1.00	
007	.204110	BOTTLE SCRUBBER 3000PSIG 1.25x1.0-0.75BP	1.00	1.00	
008	.205105	BOTTLE PULS. 5500PSIG 0.75x0.75-0.75BP	3.00	3.00	
009	.205742	COOLER SECTION 8P-4T 12N 5000PSI	1.00	1.00	
010	.307014	VALVE CHECK SS 4400 0.500FNPT @6000PSI	1.00	1.00	
011	.202579-00	FILTER COALESCING CF-5500-5-CS W/ELEM	1.00	1.00	
012	.308536	VALVE BALL SS B6L 2WAY 0.375T W/ACT N.I	1.00	1.00	
013	.307013	VALVE CHECK SS 4400 0.375FNPT @6000PSI	1.00	1.00	
014	.203934	RECOVERY TANK RT1200-105V	1.00	1.00	
015	.320894	VALVE BALL CS 0.750FNPT W/ACT	1.00	1.00	
016	.330056	VALVE GLOBE CS 0.75 FNPT ANSI800 2000PSI	1.00	1.00	
017	.307518	VALVE BALL BRASS 5044A 0.750FNPT CLS60	1.00	1.00	
018	.327439	VALVE NEEDLE CS 0.500FNPT - 0.500FNPT	1.00	1.00	
019	.332207	VALVE NEEDLE CS 0.250MNPT - 0.250FNPT	6.00	6.00	
020	.332337	VALVE RELIEF 0.75MNPT-1.00FNPT 2450 PSI	1.00	1.00	
021	.332168	VALVE RELIEF 0.75MNPT-1.00FNPT 5000 PSI	1.00	1.00	
022	.332533	VALVE RELIEF 0.75MNPT-1.00FNPT 1000 PSI	1.00	1.00	
023	.322603	GAUGE PRES 2.5IN DIAL 138 BAR/2000 PSIG	2.00	2.00	
024	.319947	TRANSMITTER PRES 0-2000 PSIG 0.250MNPT	1.00	1.00	
025	.322458	GAUGE PRES 2.5IN DIAL 210 BAR/ 3000 PSIG	1.00	1.00	
026	.322604	GAUGE PRES 2.5IN DIAL 414 BAR/ 6000 PSIG	2.00	2.00	
027	.322603	GAUGE PRES 2.5IN DIAL 138 BAR/2000 PSIG	1.00	1.00	
028	.319942	TRANSMITTER PRES 0-6000 PSIG 0.250MNPT	1.00	1.00	
029	.203340-01	THERMOWELL 5000 PSI 1/2NPT X 2.5 LG	2.00	2.00	
030	.320219	GAUGE TEMP SWITCH 180-350F	2.00	2.00	
032	.322234	TRANSMITTER PRES 0-3000 PSIG 0.250MNPT	1.00	1.00	
034	.309126	VALVE BALL SS B8L 2WAY 0.500FNPT	1.00	1.00	

----- End of List -----

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REVISION HISTORY	
ALL SHEETS SAME REVISION STATUS. HISTORY FILE: [DWG.NO.]REV.DOC	LAST REVISED 2008/01/18

DRAWING NOTES

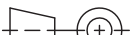

- D1. OIL TO CROSSHEADS IS PROVIDED BY
CRANKSHAFT OIL. AND EXTERNAL
LUBRICATION
D2. DISTANCE PIECE OIL DRAIN TO BE
DRAINED ABOVE OIL LEVEL.
D3. DISTANCE PIECE VENT TO BE VENTED
TO VENT HEADER.

REFERENCES

LEGEND: FD-0579

DESIGN PRESSURE-TEMPERATURE, SCHEDULE 'D'

STATION	PRESSURE PSIG	MIN. TEMP. °F	MAX. TEMP. °F
1	100	-20	300

						IMW Industries Ltd. Chilliwack, BC, Canada	
REF.		TITLE LUBRICATION CIRCUIT IMW50 COMPRESSOR 3 STAGE EXTERNAL					
DR. BVK12006/11/06							
CK. / /							
AP. / /							
		SIZE B		DWG. NO. 400046-XX		REV B	
		SCALE NONE		WEIGHT N/A		SHEET 1/1	



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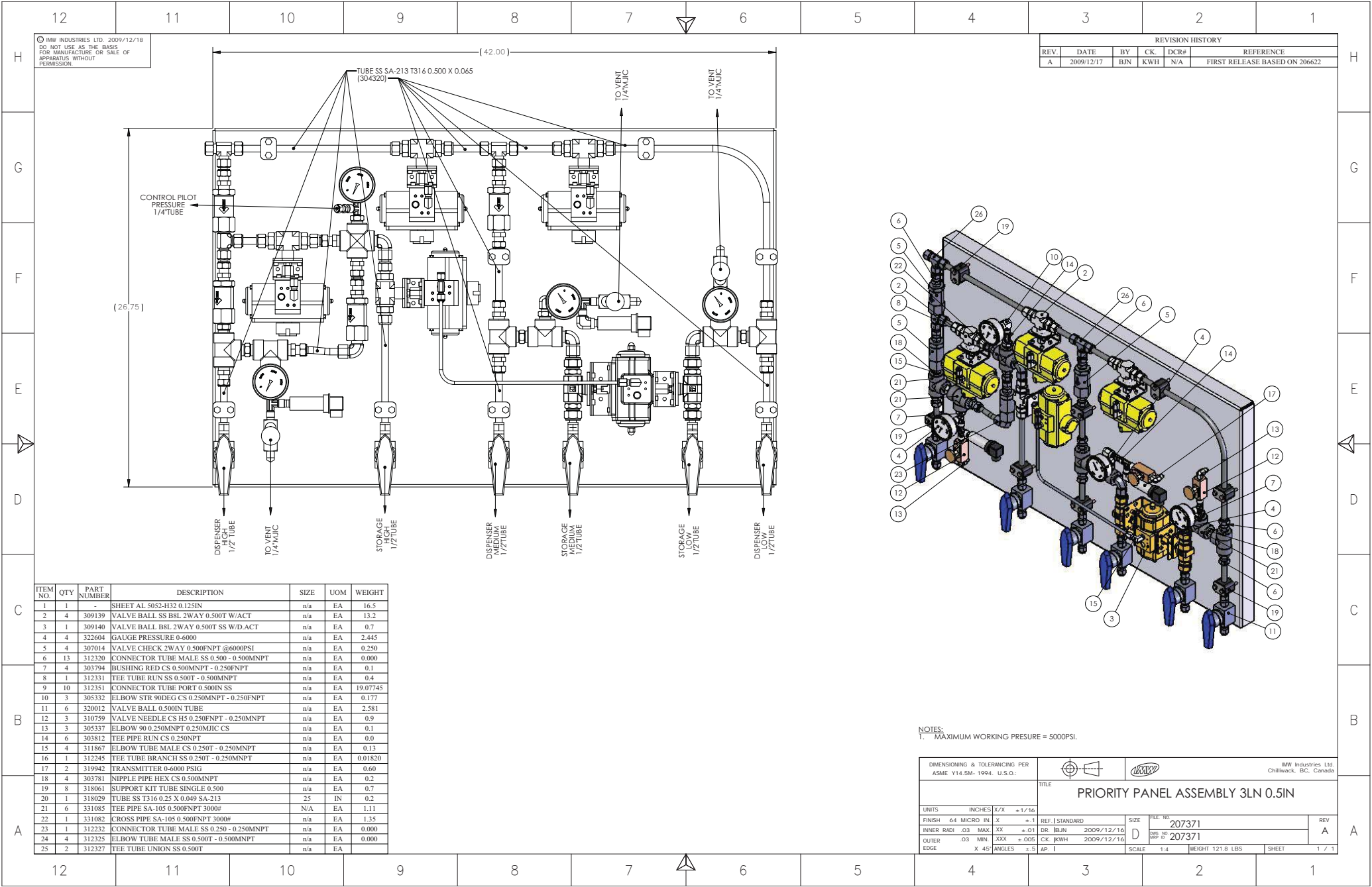
Parts and Components of Engineering Master

WorkOrder/Eng. Master: 400046-02

<i>Ref</i>	<i>Part ID</i>	<i>Description</i>	<i>QTY</i> <i>per Asm</i>	<i>QTY</i> <i>per W/O</i>	<i>Sub</i> <i>W/O</i>
----	.311421	HEATER BLOCK OIL 3/4NPT 120V 150W	1.00	1.00	
----	.310309	THERMOSTAT 40-60F 120VACX15A 0.250NPT	1.00	1.00	
----	.310999	SWITCH LEVEL L971 4A@250VAC	1.00	1.00	
----	.319462	HOSE HYDRAULIC 1/4 SINGLE BRAID	1.00	9.63	
----	.202589-00	OIL DISTRIBUTION MANIFOLD MOUNT	1.00	1.00	
001	.307512	VALVE BALL 5044A 2WAY 1.000FNPT	1.00	1.00	
002	.310983	FILTER OIL L1 HP1	1.00	1.00	
003	.305311	SWITCH PRES 20PE 0.125MNPT 0-100PSI	1.00	1.00	
004	.312285	ELBOW TUBE MALE SS 0.375T - 0.375MNPT	3.00	3.00	
005	.312282	CONNECTOR TUBE MALE 0.375 - 0.500MNPT	1.00	1.00	
006	.201806	CROSS HEAD GUIDE OIL DISTRIBUTION	1.00	1.00	
007	.320020	CONNECTOR TUBE MALE 0.125 - 0.250MNPT	1.00	1.00	
008	.312239	ELBOW TUBE MALE SS 0.250T - 0.250MNPT	9.00	9.00	
009	.310213	PLUG AL 0.500NPT	1.00	1.00	
010	.312258	ELBOW TUBE UNION SS 0.250T	2.00	2.00	
011	.312241	TEE TUBE UNION SS 0.250T	3.00	3.00	
012	.311880	CONNECTOR TUBE MALE 0.375 - 0.375MNPT	2.00	2.00	
013	.312277	CONNECTOR TUBE MALE 0.375 - 0.750MNPT	2.00	2.00	
014	.316824	BUSHING PIPE CS 1.000MNPT X 0.750FNPT	1.00	1.00	
015	.305378	TEE PIPE BRANCH CS 1.000FNPT -	1.00	1.00	
016	.312155	ELBOW TUBE MALE SS 0.750 - 1.000MNPT	1.00	1.00	
017	.312154	ELBOW TUBE MALE SS 0.750 - 0.750MNPT	1.00	1.00	
018	.321181	VALVE CHECK SWING BRASS 0.750 FNPT	1.00	1.00	
019	.305327	ELBOW MALE 90DEG 0.750MNPT	1.00	1.00	
020	.311895	CONNECTOR TUBE MALE 0.500 - 0.500MNPT	2.00	2.00	
021	.311897	ELBOW TUBE MALE CS 0.500T - 0.375MNPT	2.00	2.00	
022	.300669	NIPPLE PIPE CS 1.000MNPT X 2.000	1.00	1.00	

<i>Ref</i>	<i>Part ID</i>	<i>Description</i>	<i>QTY</i> <i>per Asm</i>	<i>QTY</i> <i>per W/O</i>	<i>Sub</i> <i>W/O</i>
023	.301156	UNION PIPE CS 0.500FNPT	2.00	2.00	
024	.300666	NIPPLE PIPE CS 0.500MNPT X 1.500	2.00	2.00	
101	.302881	PIPE SS 0.375 X SCH40	1.00	1.00	
102	.318982	PIPE SS 0.750 X SCH40	1.00	1.00	
103	.302878	PIPE SS 0.500 X SCH40	1.00	1.00	
104	.302882	PIPE SS 0.250 X SCH40	1.00	1.00	

----- End of List -----



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REVISION HISTORY				
REV.	DATE	BY	CHK	REFERENCE
A	2009/12/17	B/JN	K/WH	N/A FIRST RELEASE BASED ON 206622

ITEM NO.	QTY	PART NUMBER	DESCRIPTION	SIZE	UOM	WEIGHT
1	1	-	SHEET AL 5052-H32 0.125IN	n/a	EA	16.5
2	4	309139	VALVE BALL SS BSL 2WAY 0.500T W/ACT	n/a	EA	13.2
3	1	309140	VALVE BALL BSL 2WAY 0.500T SS W/D.ACT	n/a	EA	0.7
4	4	322604	GAUGE PRESSURE 0-6000	n/a	EA	2.445
5	4	307014	VALVE CHECK 2WAY 0.500FNPT @6000PSI	n/a	EA	0.250
6	13	312320	CONNECTOR TUBE MALE SS 0.500 - 0.500MNPT	n/a	EA	0.000
7	4	303794	BUSHING RED CS 0.500MNPT - 0.250FNPT	n/a	EA	0.1
8	1	312331	TEE TUBE RUN SS 0.500T - 0.500MNPT	n/a	EA	0.4
9	10	312351	CONNECTOR TUBE PORT 0.500IN SS	n/a	EA	19.07745
10	3	305332	ELBOW STR 90DEG CS 0.250MNPT - 0.250FNPT	n/a	EA	0.177
11	6	320012	VALVE BALL 0.500IN TUBE	n/a	EA	2.581
12	3	310759	VALVE NEEDLE CS HS 0.250FNPT - 0.250MNPT	n/a	EA	0.9
13	3	305337	ELBOW 90 0.250MNPT 0.250MJC CS	n/a	EA	0.1
14	6	303812	TEE PIPE RUN CS 0.250NPT	n/a	EA	0.0
15	4	311867	ELBOW TUBE MALE CS 0.250T - 0.250MNPT	n/a	EA	0.13
16	1	312245	TEE TUBE BRANCH SS 0.250T - 0.250MNPT	n/a	EA	0.01820
17	2	319942	TRANSMITTER 0-6000 PSIG	n/a	EA	0.60
18	4	303781	NIPPLE PIPE HEX CS 0.500MNPT	n/a	EA	0.2
19	8	318061	SUPPORT KIT TUBE SINGLE 0.500	n/a	EA	0.7
20	1	318029	TUBE SS T316 0.25 X 0.049 SA-213	25	IN	0.2
21	6	331085	TEE PIPE SA-105 0.500FNPT 3000#	N/A	EA	1.11
22	1	331082	CROSS PIPE SA-105 0.500FNPT 3000#	n/a	EA	1.35
23	1	312322	CONNECTOR TUBE MALE SS 0.250 - 0.250MNPT	n/a	EA	0.000
24	4	312325	ELBOW TUBE MALE SS 0.500T - 0.500MNPT	n/a	EA	0.000
25	2	312327	TEE TUBE UNION SS 0.500T	n/a	EA	

NOTES:
1. MAXIMUM WORKING PRESURE = 5000PSI.

DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994, U.S.O.:		TITLE PRIORITY PANEL ASSEMBLY 3LN 0.5IN	
UNITS	INCHES X/X ±1/16	SIZE	FILE NO. 207371
FINISH	64 MICRO IN. X ±.1	REF. STANDARD	DR. IB/JN 2009/12/16
INNER RADI	.03 MAX. .XX ±.01	CK. JK/WH 2009/12/16	REV A
OUTER EDGE	.03 MIN. .XXX ±.005	SCALE	1:4
	X 45° ANGLES ±.5	WEIGHT	121.8 LBS
		SHEET	1 / 1



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IMW COMPRESSOR MANUAL ADDITIONAL DOCUMENT LIST

The additional documents section of the IMW compressor manual consists of any documents not suited for another appendix.

As with the Main Document List, this document lists the complete set of items that comprise the IMW compressor manual additional documents appendix.

Description	Document Number	Revision	Pages
MANUFACTURERS CERTIFICATE OF QUALITY	FO-QC-2004-007	0	1
ASME U-1A (RECOVERY TANK) RT 1293	N/A	N/A	1
HEAT EXCHANGER DOCUMENTATION 54612-1	N/A	2011-03-31	8
HEAT EXCHANGER DOCUMENTATION 54613-1	N/A	2011-03-02	8
SCRUBBER DOCUMENTATION 53827-5 53827-9	N/A	2011-02-16 2011-02-18	8
SCRUBBER DOCUMENTATION 54304-1	N/A	2011-02-22	8
PULSATION DOCUMENTATION 50382-6 52300-1/ 52300-2	N/A	2011-01-05 2011-01-18	20
PRESSURE RELIEF VALVE CERTIFICATES 617046/ 653772/ 664929/ 668258/ 678126	N/A	N/A	5
PULSATION FILTER DOCUMENTATION 50164-11/ 50164-16/ 50164-18/ 55046-5	N/A	2011-02-14	8
COMPRESSOR NAMEPLATE	N/A	N/A	2



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MANUFACTURER'S CERTIFICATE OF QUALITY

COMPRESSORS

Clean Energy Compression Corp. dba I.M.W. Industries (IMW, IMW Industries) hereby certifies that IMW is the manufacturer of the following compressed natural gas (CNG) fueling equipment:

Type: CNG Compressor

Model: IMW50-2X1750SA-75-4500-2AC

Serial #: 52491

Year: 2011

IMW Industries certifies that this equipment is manufactured with new materials and components only and is designed and certified in accordance with the applicable codes and standards set forth for the manufacture of CNG equipment in North America (table below).

IMW Industries certifies that all electrical components incorporated into this equipment are approved by the Canadian Standards Association (CSA) or Underwriter's Laboratories (UL) and are suitable for the environment in which they are used.

IMW Industries certifies that this equipment is suitable for the purpose for which it was designed and can be operated safely when used in accordance with the manufacturer's instructions and recommendations.

The equipment referenced on the certificate has been manufactured / assembled in Canada.

COMPONENT / ASSEMBLY	CODE / STANDARD	CERTIFICATION
Compressor Unit	ANSI NGV 4.8/CSA 12.8, NFPA 52	Comply in Design/Purchase/Manufacture
Electrical Components	CSA, UL	Third Party (as required)
Electrical Panels / Wiring	CSA C22.1, NFPA 52, NFPA 70	Third Party (as required)
Pressure Piping & Fittings	ASME B31.3, CSA B51	BC Safety Authority "MA" Licence
Pressure Vessels	ASME Section VIII, Div.1, CSA B51	ASME "U" Certificate Of Authorization, National Board Certificate of Authorization to Register & BC Safety Authority "MA" Licence
Quality System	ISO 9001	QMI-SAI Certificate of Registration
Relief valves	ASME Section VIII, Div.1	"UV" Stamped By Other

CODE / STANDARD	DESCRIPTION
ANSI NGV 4.8/CSA 12.8	Natural Gas Fueling Station Reciprocating Compressor Guidelines
ASME B31.3	Process Piping Code
ASME Section VIII, Div.1	American Society Of Mechanical Engineers Boiler & Pressure Vessel Code
CSA	Canadian Standards Association
CSA B51	Boiler, Pressure Vessel and Pressure Piping Code
CSA C22.1	Canadian Electrical Code, Part I, Safety Standard for Electrical Installations
ISO 9001	Quality Management System Requirements
NFPA 52	Vehicular Gaseous Fuel Systems Code
NFPA 70	National Electrical Code
UL	Underwriters Laboratories

Certified true and correct,

Brad Miller
President

www.imw.ca

IMW Industries 43676 Progress Way, Chilliwack, BC, Canada V2R 0C3 Tel: 604-795-9491 Fax: 604-792-3806 info@imw.ca

FO-QC-2004-007

Rev.7

Page 1 of 1



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FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS
(Alternative Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)
As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by: IMW Industries Ltd. 43676 Progress Way, Chilliwack, British Columbia Canada V2P 1B5
(Name and address of manufacturer)

2. Manufactured for: Devan Gas
(Name and address of purchaser)

3. Location of installation Dunvegan, Alberta, Canada
(Name and address)

4. Type: Vertical RT-1293 V3808.2 203934 Rev. J 154 2011
(Horizontal or vertical tank) (Manufacturer's serial Number) (CRN) (Drawing number) (National Board number) (Year built)

5. The chemical and physical properties of all parts meet the requirements of material specifications of the ASME BOILER AND PRESSURE VESSEL CODE The design, construction, and workmanship conform to ASME Rules, Section VIII, Division 1 2010
Year

to n/a n/a n/a
Addenda (Date) (Code Case numbers) [Special Service per UG-120 (d)]

6. Shell SA106 GR.B 0.969" none 22.062" 79-29/32"
Material spec. number, grade) Nominal thickness (Corr. allow) (Inner diameter) Length (overall)

7. Seams: n/a n/a n/a n/a n/a TYPE 1 Spot 100 1
[Long (welded, dbl. singl., lap, butt)] R.T. (spot or full) (Eff.) (H.T. temp.) (Time, hr) [Girth (welded, dbl. singl., lap, butt)] [R.T. (spot or full)] (Eff. %) No. of courses

8. Heads: (a) Material SA-516 GR.70 (b) Material SA-516 GR.70
(Spec. number, grade) (Spec. number, grade)

	Location (Top, Bottom, Ends)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure (Convex or Concave)
(a)	END	0.938"	0	n/a	n/a	2:1	n/a	n/a	n/a	Concave
(b)	END	0.938"	0	n/a	n/a	2:1	n/a	n/a	n/a	Concave

If removable, bolts used (describe other fastenings) n/a
(Material spec. number, grade, size, number)

9. MAWP 1200 n/a psi at max temp. 300 n/a ° F
(Internal) (External) (Internal) (External)

Min. design metal temp. -20 F at 1200 psi Hydro. pneu., or comb. test press. Hydro 1560 psi.

Proof Test n/a

10. Nozzles, inspection, and safety valve openings:

Purpose (Inlet, Outlet, Drain)	Number	Diameter or Size	Type	Material	Nominal Thickness	Reinforcement Material	How Attached	Location
Nozzle	1	0.75"	H. Coupling	SA-105	0.350"	N/A	Welded	Shell
Nozzle	1	1.00	H. Coupling	SA-105	.441"	N/A	Welded	Shell
Safety Valve	1	0.75"	H. Coupling	SA-105	0.350"	N/A	Welded	Shell
Nozzle	1	2.0"	F. Coupling	SA-105	0.622"	N/A	Welded	Cap
Inspection	1	2.0"	F. Coupling	SA-105	0.622"	N/A	Welded	Cap

11. Supports: Skirt Yes Lugs None Legs None Others N/A Attached N/A
(Yes or No) (No.) (No.) (Describe) (Where and How)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report: n/a
(Name of part, item number, Manufacturer's name and identifying stamp)

Tested in horizontal position. Impact test not required as per ASME Sec.8, Div.1 UG-20(f), For non-corrosive service

Over pressure protection is the responsibility of the manufacturer as per ASME Section VIII, Div 1 UG-125(a).

CERTIFICATE OF SHOP/FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction and workmanship of this vessel conform to the ASME Boiler and pressure Vessel Code, Section VIII, Division 1. "U" Certificate of Authorization Number 30,572
expires 2013/09/16

Date 2011/03/09 Co. Name IMW Industries Ltd. Signed Quality Assurance Manager (Representative)
(Manufacturer)

CERTIFICATE OF SHOP/FIELD INSPECTION

Vessel constructed by IMW Industries Ltd. at IMW Industries Ltd.
43676 Progress Way, Chilliwack, BC V2R 0C3

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of British Columbia and employed by British Columbia Safety Authority
have inspected the component described in this Manufacturer's Data Report on 2011/03/09, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel this described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 2011/03/09 Signed Commissions NB 12255ABN/BC 73
(Authorized Inspector) [National Board (incl endorsements) State, Prov. and number]



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IMW PRESSURE TEST REPORT

Test Standard

CSA B51

UNIT UNDER TEST (UUT) DATA		TEST REQUIREMENTS	
Work Order ID	54612	Type (media)	Pneumatic (air)
Part ID	205742	Design Pressure (PSIG)	5000
Part Description	Cooler Section, 8P-4T, 12N	Test Pressure (PSIG)	5500
Sequence ID	10	(Approx. 379.21 BAR, 37921.17 kPa)	
Serial #	54612-1	Duration (minutes)	15
Drawing ID (incl Rev.)	205742 Rev D		

PRESSURE GAUGE(S) USED				
Serial #	Description	Range	Accuracy +/-	Cal. Due
PRIMARY				
IMW-550	Gauge, Digital Pressure	0 to 10000 PSIG	50 PSIG	2011/12/09
SECONDARY (If Used)				
IMW-551	Gauge, Digital Pressure	0 to 10000 PSIG	50 PSIG	2011/12/09

TEST DATA				
MDMT (see drawing) -20		Test Commenced On (YYYY/MM/DD)		2011/02/28
PART DESCRIPTION	HEAT NUMBER	PART DESCRIPTION	HEAT NUMBER	HT# VERIFICATION
Header, Port	A105036	Tube	2102-09047	All Heat Numbers Verified (Certs on File). Checked By: John Simpson
Header, Return	A105036			
Plugs	109335 (2)			
Plugs	M647022			
Metal Temp (> MDMT +30 F)		WATER TEMP >70F (ASME SECT I)		
Test Commenced By	John Simpson	Witnessed By		N/A
Employee #	675	Employee #		N/A
* Pressure increased incrementally prior to Test Steps below.				
Test Steps	Target (PSIG)	Actual Readings (PSIG)		Time
		Primary Gauge	Secondary Gauge	
(1) Pressure On	5,000	5050	5060	7:17 PM
(2) Pressure Off	5,050	5050	5060	7:40 PM
Test Completed By	John Simpson	Witnessed By		N/A
Employee #	675	Employee #		N/A
AI Acceptance (when req'd):		Date:		

NOTES

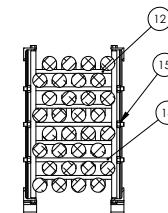
RESULTS
Pressure gauge(s) used were calibrated and traceable to National and/or International Standards. IMW hereby certifies the UUT stated above was tested with the following results:
<ul style="list-style-type: none"> ✓ Valid Pressure Gauge(s) Used ✓ Heat Numbers Verified ✓ Test Pressure Attained ✓ Test Pressure Maintained ✓ Test Duration Attained ✓ Pneumatic (air) Test Type Confirmed
Report Completed By: kgrist
Report Date: 2011/03/31
PASS



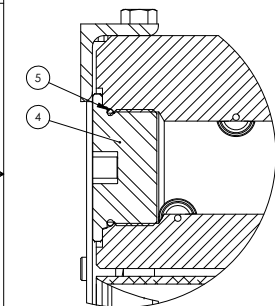
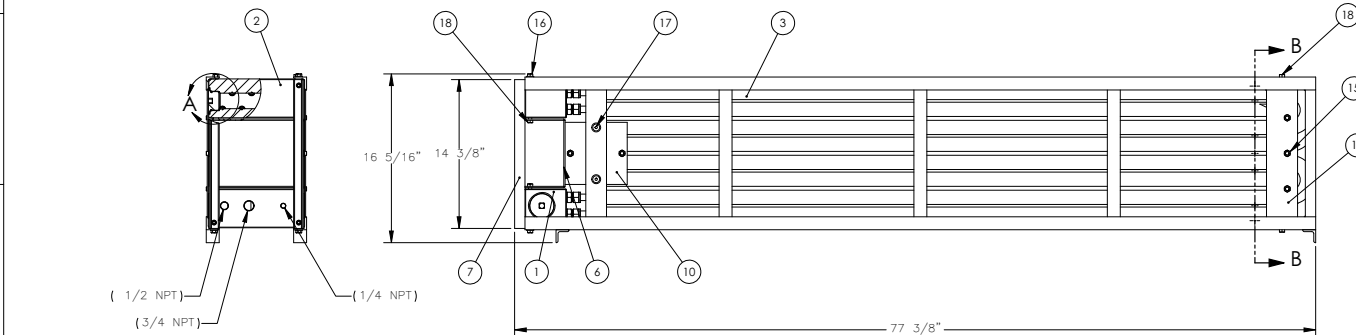
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DO NOT USE AS THE BASIS
FOR MANUFACTURE OR SALE OF
APPARATUS WITHOUT
PERMISSION.

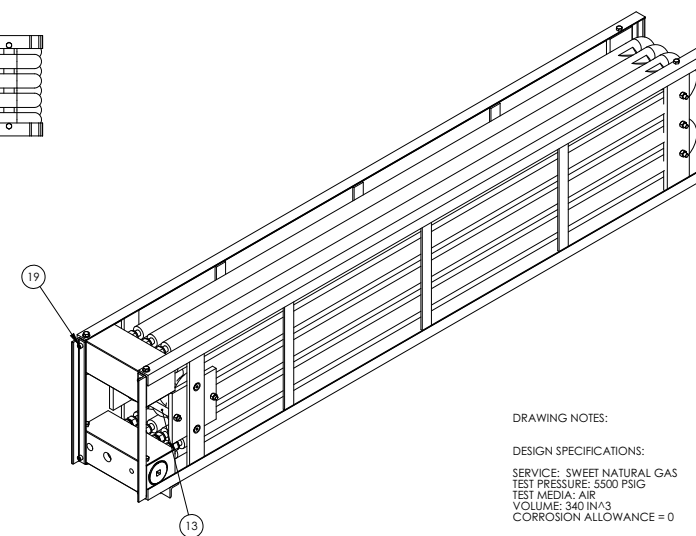
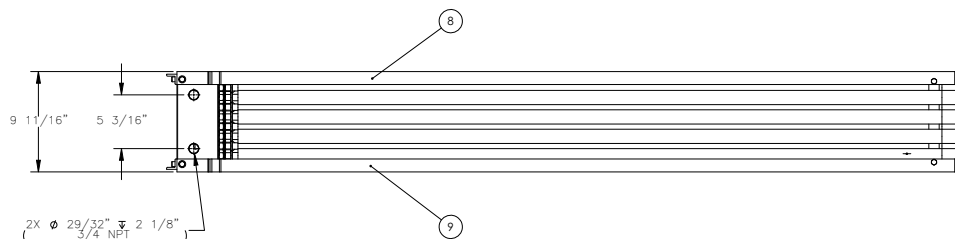
REVISION HISTORY					
REV.	DATE	DY	CK.	DCR#	REFERENCE
A	2008/07/14	DY	N/A	N/A	FIRST RELEASE
B	2009/04/29	DY	EDL	1491	ADDED 327394, CHANGED TO 306385 WAS HEX BOLT
C	2009/06/15	DY	DVL	1505	CHANGED PRESSURE TEST MEDIA FROM WATER TO AIR



SECTION B-B



DETAIL A
SCALE 1:1



DRAWING NOTES:

DESIGN SPECIFICATIONS:
SERVICE: SWEET NATURAL GAS
TEST PRESSURE: 5500 PSIG
TEST MEDIA: AIR
VOLUME: 340 IN³
CORROSION ALLOWANCE = 0

ITEM NO.	QTY	PART NUMBER	DESCRIPTION	SIZE	UOM	SPECIFICATION	WEIGHT
1	1	203307-00-12N	PORT HEADER 4 X 2	n/a	EA	CS, SA-105	31.3
2	1	203316-00	RETURN HEADER 4 TUBES PER PASS	n/a	EA	CS, SA-105	32.7
3	8	206191	FORMED FIN TUBE 4P 0.625x0.109 - PARKER	n/a	EA	SA-179	23.6
4	3	203318-00	COOLER SAE PLUG	n/a	EA	n/a	0.83
5	3	320172	ORING 2-131 V90D	n/a	EA	VITON	0.00
6	1	205603	SUPPORT RETURN HEAD 4 TUBE	n/a	EA	AL	1.6
7	2	205612	SUPPORT PORT HEADER TO RETURN HEADER	n/a	EA	CS A36	1.4
8	1	205786	COOLER SECTION RIGHT RACK	n/a	EA	CS	25.9
9	1	205787	COOLER SECTION LEFT RACK	n/a	EA	CS	25.9
10	2	205796	COOLER SECTION FRONT CLAMP	n/a	EA	AL	1.7
11	2	205797	COOLER SECTION BACK CLAMP	n/a	EA	AL	2.0
12	6	205805	COOLER SECTION TUBE SUPPORT FLAT BAR 4TUBES	n/a	EA	AL 6062	0.3
13	1	205810	COOLER SECTION TUBE SUPPORT PIPE 4 TUBES	n/a	EA	AL	0.3
14	5	205758	REDI ROD COOLER SECTION 4 TUBES	n/a	EA	n/a	0.3
15	10	301778	NUT HEX CS GR.5 0.313-18UNC X 0.500 ZN	n/a	EA	Gr. 5	0.002
16	4	307270	BOLT HH CS GR.5 0.313-18UNC X 0.500 ZN	n/a	EA	Gr. 5	0.0032
17	4	306385	SCREW MACH HEX FH SS 0.375UNC X 1.000	n/a	EA	FASTENAL# 306385	0.035
18	8	301733	BOLT HH CS GR.5 0.313-18UNC X 0.750 ZN	n/a	EA	Gr. 5	0.0039
19	4	327394	SHCS CS 0.313-18UNC X 0.750	n/a	EA	n/a	0.004
20	1	327746	HOSE POLYURETHANE BLK 0.500OD X 0.062WAL	29.25	LN	n/a	0.02

NDE REQUIREMENTS
PRESSURE TEST TO ASME SECTION VIII.
APPLICABLE DESIGN CODES
- ASME SECTION VIII, DIVISION 1, BOILER AND
PRESSURE VESSEL CODE 2007, LATEST ADDENDA
- CSA B51-03, BOILER, PRESSURE VESSEL, AND
PRESSURE PIPING CODE.

CERTIFIED BY
IMW INDUSTRIES LTD.
MAWP 5000 PSI AT 350°F
MDMT -20°F AT 5000 PSI
MFG. SERIAL NO. _____
YEAR BUILT _____
CRN _____ PROV. NO. _____

DIMENSIONING & TOLERANCING PER: ASME Y14.5M-1994, U.S.C.				TITLE		IMW		IMW Industries Ltd. Chilliwack, BC, Canada	
UNITS: INCHES 1/4 ±1/16				3/4"NPT 8 PASS 4 TUBES 5000 PSI		SIZE		REV	
FINISH: E4 MICRO IN. ±.01				REF: STANDARD		D		205742	
INNER RAD: .03 MAX. XXX ±.005				GR: I DY 2008/07/14		D		205742	
OUTER RAD: .03 MAX. XXX ±.005				SCALE: 1/8"		WEIGHT: 222.1		SHEET: 1 / 1	



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12/1/2010



VANGUARD STEEL LTD.
7880 FRASER PARK DR.
BURNABY B.C.
V5J 5L8

SICOM INDUSTRIES

PHONE: (604)- 294-3191

FAX:

(604)- 294-8845

TEST REPORT

SA105 SQUARE

SIZE: 4"
HEAT # A105036
WORKS#

DEL SLIP # A03369
PO # 58294

CHEMICAL COMPOSITION %

C	Mn	P.	S.	Si.	Cu	Ni	Cr	V	Mo	Sn	Al	Cb	N
0.250	0.780	0.006	0.018	0.240	0.190	0.080	0.140	0.002	0.030		0.170	0.001	0.010

MECHANICAL AND PHYSICAL PROPERTIES OF MATERIAL

TC PR PR	HEAT TREATMENT	* L T	Y S PSI .2%	UTS PSI	ELONG. % IN 2"	R.A. %	* L T	TEMP F.	IMPACT CVN FT. LBS	HARDNESS HBW
			42300	78800	22.9	37.5				

* CHECKED ON => TC=TEST COUPON PR=PRODUCT AS DELIVERED. L=LONGITUDE. T=TRANSVER.

OTHER RESULTS

COMFORMS TO A29/A29M-05 A105/A105M-02
REDUCTION RATIO 8.90/RED
MELTED COUNTRY USA
ROLLED COUNTRY USA

PO# 77994
78005

SICOM WO #

CUST. AC. #

R.I.R. #

16030

WO#

22067
22068
22069
22071
22076
22077
22078
22079
22080
22081

22082
22085

WE HEREBY CERTIFY THAT THE ABOVE DATA IS A TRUE COPY OF THE DATA FURNISHED US BY THE PRODUCING MILL OR SUPPLIER OR THE DATA RESULTING FROM TESTS PERFORMED IN APPROVED LABORATORIES.
WE CERTIFY THAT ABOVE MATERIALS CONFORMS TO THE REQUIREMENTS OF THE ABOVE SPECIFICATION(S).

E. O. & E.



CERTIFIED MILL TEST REPORT

BILL TO

SHIP TO

Date	09/29/2010	Customer PO	P9859-1-B702	Specifications
ASI Ord No.	38458	Customer PT.		SAE 1022
ASI Ord Line Item	1			ASTM A 572-06 GR50, ASTM A 29-05

Item Description

Steel Bar, Hot Rolled, 2:5000, 20' 2"

Strand Cast, RR = 9.98:1

Heat Number

109335

Yield PSI

56400

Tensile PSI

82800

% Elongation

24 in 2"

% ROA

42

Bend Test

CHEMICAL ANALYSIS TEST METHODS ASTM E-415 & E-1019

Heat Number	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	Al	Nb/Cb	V	B	Ti	N	Ca
109335	0.21	0.91	0.008	0.028	0.22	0.16	0.077	0.091	0.014	0.008	0.002	0.006	0.035	0.0002	0.0013	0.0109	0.0014

JOMINY HARDENABILITY USING ASTM A-255 CALCULATED FROM CHEMICAL DI

Heat Number GS DI

109335 8 0.76

SPECIAL TEST RESULTS

ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213
------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

Heat Number	TA	TB	TC	TD	HA	HB	HC	HD	S	O	S	O	S	R	C	A	B	RC	RB	EC
109335																				

ADDITIONAL COMMENTS

No mercury, lead, radium, or alpha containing material or equipment is used or deliberately added in the production of this steel. No weld or weld repairs were performed on this material. This Steel is 100% Electric Arc Furnace Melted and Rolled in the U.S.A. Material qualifies as NAFTA origination.

Subscribed and sworn to before me, a Notary Public, in and for the county of Madison, State of Illinois

this _____ Day of _____

My commission expires _____

(Notary Public)

Alteration or reproduction of this report, except in full, is not allowed without written approval by a representative of Alton Steel Incorporated.

I hereby certify that the above tests are correct as contained in the records of ALTON STEEL INCORPORATED

Quality Leader: Robert Cauley

R Cauley

encore-metals

Encore Metals
7470 Vantage Way
DELTA, B.C. V4G 1H1

From

CERTIFICATION OF ANALYSIS AND TESTS

ISO 9001
Certified

For:
ENCORE METALS INC
6925-8TH STREET NW
EDMONTON
CANADA, T6P-1T9

Date: 07/07/10
Your Order No. B100605
Our Invoice No. 186978
Our S.O. No. 130781
ID# 99
0000120995

Description of Material and Specifications

2.5" HR-RE A105K20'02"

Chemical Analysis

Heat
M647022

C	Mn	P	S	Si	Ni	Cr	Mo	Al
.21	.88	.013	.025	.230	.11	.14	.032	.002
Cu	Ti	V	Co	Sn				
.31	.001	.026	.002	.009				

Mechanical Properties

Tensile	Yield	Elong	R.A.	D.I.
80000	51000	27% 2"	54	.88

FOR APPROVAL

CA

KTSC..

RECEIVED JUL 15 2010

Certificate of Tests shall not be reproduced except in full. The material was not exposed to mercury or any metal alloy that is liquid at ambient temperature during processing or while in our possession. No weld or weld repair was performed on this material. We hereby certify that the foregoing data is a true copy of the data furnished by our supplier or resulting from test performed for our company.

Director Metallurgy and Quality
John G. Asimou

V. 1-8



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IMW PRESSURE TEST REPORT

Test Standard

CSA B51

UNIT UNDER TEST (UUT) DATA		TEST REQUIREMENTS	
Work Order ID	54613	Type (media)	Pneumatic (air)
Part ID	206051	Design Pressure (PSIG)	2500
Part Description	Cooler Section, 4P-12T, 24N	Test Pressure (PSIG)	2750
Sequence ID	20	(Approx. 189.61 BAR, 18960.59 kPa)	
Serial #	54613-1	Duration (minutes)	15
Drawing ID (incl Rev.)	206051 Rev F		

PRESSURE GAUGE(S) USED				
Serial #	Description	Range	Accuracy +/-	Cal. Due
PRIMARY				
IMW-530	Gauge, Pressure	0 to 5000 PSIG	50 PSIG	2011/11/05
SECONDARY (If Used)				
IMW-531	Gauge, Pressure	0 to 5000 PSIG	50 PSIG	2011/11/05

TEST DATA				
MDMT (see drawing)		Test Commenced On (YYYY/MM/DD)		2011/02/28
-20				
PART DESCRIPTION	HEAT NUMBER	PART DESCRIPTION	HEAT NUMBER	HT# VERIFICATION
Inlet Header	A105036	Tube	01009-0673	All Heat Numbers Verified (Certs on File). Checked By: Mdunstan
Outlet Header	90881			
Plugs	M647022			
Plugs	109335 (x3)			
Metal Temp (> MDMT +30 F)		WATER TEMP >70F (ASME SECT I)		
Test Commenced By	Mdunstan	Witnessed By		N/A
Employee #	476	Employee #		N/A
* Pressure increased incrementally prior to Test Steps below.				
Test Steps	Target (PSIG)	Actual Readings (PSIG)		Time
		Primary Gauge	Secondary Gauge	
(1) Pressure On	2,500	2500	2500	9:10 PM
(2) Pressure Off	2,500	2500	2500	9:35 PM
Test Completed By	Mdunstan	Witnessed By		N/A
Employee #	476	Employee #		N/A
AI Acceptance (when req'd):		Date:		

NOTES

RESULTS
Pressure gauge(s) used were calibrated and traceable to National and/or International Standards. IMW hereby certifies the UUT stated above was tested with the following results: <ul style="list-style-type: none">✓ Valid Pressure Gauge(s) Used✓ Heat Numbers Verified✓ Test Pressure Attained✓ Test Pressure Maintained✓ Test Duration Attained✓ Pneumatic (air) Test Type Confirmed
PASS
Report Completed By: Mdunstan Report Date: 2011/03/02

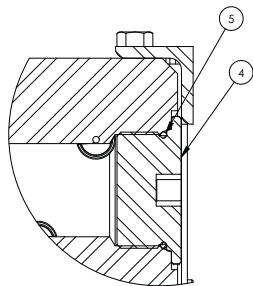
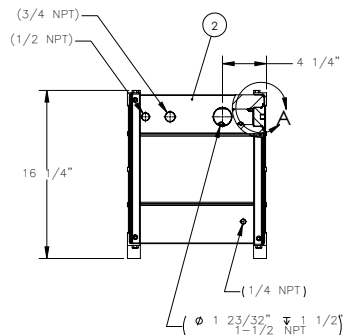


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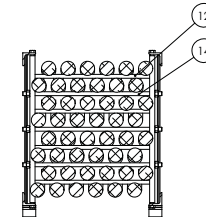
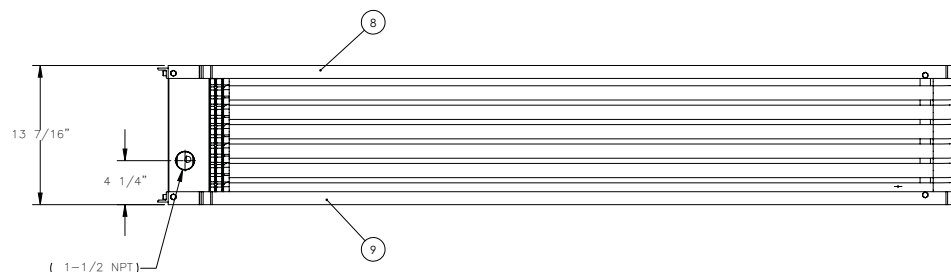
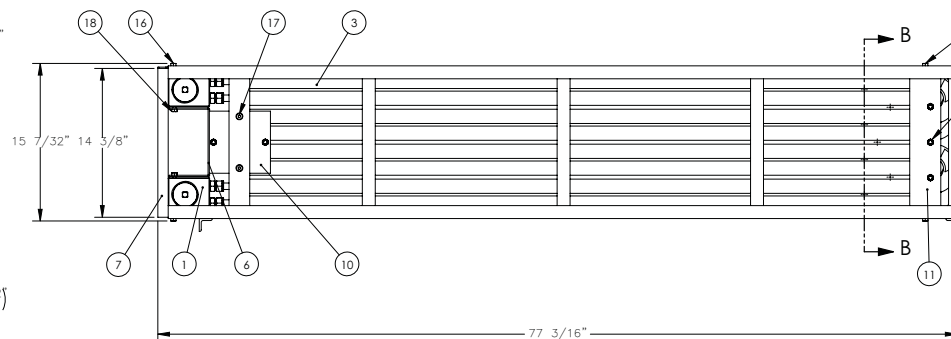
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PERMISSION.

REVISION HISTORY

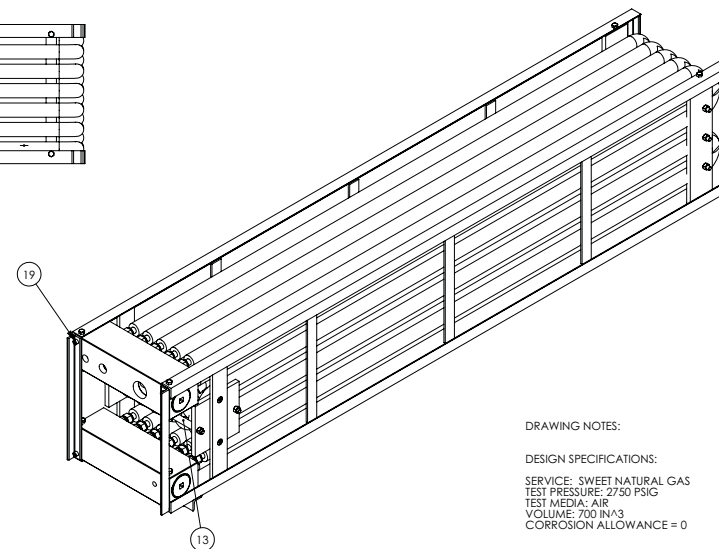
REV.	DATE	BY	CK.	DCR#	REFERENCE
A	2008/10/14	DY	N/A	N/A	FIRST RELEASE BASED ON 205734
B	2009/04/30	DY	EDL	1491	ADDED 327594; CHANGED TO 306385 WAS HEX BOLT
C	2009/06/16	DY	BVK	1415	MOVED 1/2" & 3/4" NPT PORTS
D	2009/06/16	DY	DVL	1505	CHANGED PRESSURE TEST MEDIA FROM WATER TO AIR



DETAIL A
SCALE 1:1



SECTION B-B



DRAWING NOTES:

DESIGN SPECIFICATIONS:
SERVICE: SWEET NATURAL GAS
TEST PRESSURE: 2750 PSIG
TEST MEDIA: AIR
VOLUME: 700 IN³
CORROSION ALLOWANCE = 0

ITEM NO.	QTY	PART NUMBER	DESCRIPTION	SIZE	UOM	SPECIFICATION	WEIGHT
1	1	206052	PORT HEADER 12 PORT INLET 24F CONNECTION	n/a	EA	SA-105	43.3
2	1	206053	PORT HEADER 12PORT RETURN 24F CONN	n/a	EA	CS, SA-105	43.3
3	12	206190	FORMED FIN TUBE 4P 0.625x0.065 - PARKER	n/a	EA	SA-179	23.5
4	4	203318-00	COOLER SAE PLUG	n/a	EA	n/a	0.83
5	4	320172	ORING 2-131 V90D	n/a	EA	VTITON	0.00
6	1	205601	RETURN HEAD SUPPORT	n/a	EA	AL	2.2
7	2	205612	SUPPORT PORT HEADER TO RETURN HEADER	n/a	EA	CS A36	1.4
8	1	205786	COOLER SECTION RIGHT RACK	n/a	EA	CS	25.9
9	1	205787	COOLER SECTION LEFT RACK	n/a	EA	CS	25.9
10	2	205796	COOLER SECTION FRONT CLAMP	n/a	EA	AL	1.7
11	2	205797	COOLER SECTION BACK CLAMP	n/a	EA	AL	2.0
12	6	205803	COOLER SECTION TUBE SUPPORT FLAT BAR 6TU	n/a	EA	A36	1.2
13	1	205808	COOLER SECTION TUBE SUPPORT PIPE 6 TUBES	n/a	EA	AL	0.5
14	5	205754	REDI ROD COOLER SECTION 6 TUBES	n/a	EA	n/a	0.4
15	10	301778	NUT HEX CS GR.5 0.375UNC ZN	n/a	EA	Gr. 5	0.002
16	4	307270	BOLT HH CS GR.5 0.313-18UNC X 0.500 ZN	n/a	EA	Gr. 5	0.0032
17	4	306385	SCREW MACH HEX FH SS 0.375UNC X 1.000	n/a	EA	PASTENAL# 306385	0.035
18	8	301733	BOLT HH CS GR.5 0.313-18UNC X 0.750 ZN	n/a	EA	Gr. 5	0.0039
19	4	327594	SHCS CS 0.313-18UNC X 0.750	n/a	EA	n/a	0.004
20	1	327746	HOSE POLYURETHANE BLK 0.500OD X 0.062WAL	44.25	LN	n/a	0.02

NDE REQUIREMENTS
PRESSURE TEST TO ASME SECTION VIII.
APPLICABLE DESIGN CODES
- ASME SECTION VIII, DIVISION 1, BOILER AND
PRESSURE VESSEL CODE 2007, LATEST ADDENDA.
- CSA B51-03, BOILER, PRESSURE VESSEL, AND
PRESSURE PIPING CODE.

CERTIFIED BY
IMW INDUSTRIES LTD.

MAWP 2500 PSI AT 350°F
MDMT -20°F AT 2500 PSI
MFG. SERIAL NO. _____
YEAR BUILT _____

CRN _____ PROV. NO. _____

DIMENSIONING & TOLERANCING PER: ASME Y14.5M-1994, U.S.O.				TITLE		IMW		IMW INDUSTRIES LTD. Chilliwack, BC, Canada	
UNITS: INCHES 1/4 ±1/16				COOLER SECTION		206051		REV	
FINISH: 64 MICRO IN.				4 PASS 12 TUBES 24N 2500 PSI		D		D	
TOLERANCE: 0.03 MAX. 0.01 MIN.				DATE: 2009/10/14		SIZE: 206051		REV: 206051	
OUTER RADIUS: 0.03 MIN.				SCALE: 1/8"		WEIGHT: 445.8		SHEET: 1 / 1	



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12/1/2010



VANGUARD STEEL LTD.
7880 FRASER PARK DR.
BURNABY B.C.
V5J 5L8

SICOM INDUSTRIES

PHONE: (604)- 294-3191

FAX:

(604)- 294-8845

TEST REPORT

SAISI SA105 SQUARE

SIZE: 4"
HEAT # A105036
WORKS#

DEL SLIP # A03369
PO # 58294

CHEMICAL COMPOSITION %

C	Mn	P.	S.	Si.	Cu	Ni	Cr	V	Mo	Sn	Al	Cb	N
0.250	0.780	0.006	0.018	0.240	0.190	0.080	0.140	0.002	0.030		0.170	0.001	0.010

MECHANICAL AND PHYSICAL PROPERTIES OF MATERIAL

* TC PR	HEAT TREATMENT	* L T	YS PSI .2%	UTS PSI	ELONG. % IN 2"	R.A. %	* L T	TEMP F.	IMPACT CVN FT. LBS	HARDNESS HBW
PR			42300	78800	22.9	37.5				

* CHECKED ON => TC=TEST COUPON PR=PRODUCT AS DELIVERED. L=LONGITUDE. T=TRANSVER.

OTHER RESULTS

COMFORMS TO A29/A29M-05 A105/A105M-02
REDUCTION RATIO 8.90/RED
MELTED COUNTRY USA
ROLLED COUNTRY USA

PO# 77994
78005

SICOM WO #

CUST. AC. #

R.I.R. #

16030

WO#

22067
22068
22069
22071
22076
22077
22078
22079
22080
22081

22082
22085

WE HEREBY CERTIFY THAT THE ABOVE DATA IS A TRUE COPY OF THE DATA FURNISHED US BY THE PRODUCING MILL OR SUPPLIER OR THE DATA RESULTING FROM TESTS PERFORMED IN APPROVED LABORATORIES.
WE CERTIFY THAT ABOVE MATERIALS CONFORMS TO THE REQUIREMENTS OF THE ABOVE SPECIFICATION(S).

E. O. & E.

07/22/2010



VANGUARD STEEL LTD.
7880 FRASER PARK DR.
BURNABY B.C.
V5J 5L8

IMW INDUSTRIES LTD

PHONE: (604)- 294-3191

FAX: (604)- 294-8845

TEST REPORT

AISI SA105 SQUARE

SIZE: 4"

DEL SLIP #

V97541

HEAT # 90881

PO #

74285

WORKS#

CHEMICAL COMPOSITION %

C	Mn	P.	S.	Si.	Cu	Ni	Cr	V	Mo	Sn	Al	Cb	N	
0.260	0.840	0.011	0.020	0.250	0.280	0.140	0.200	0.002	0.050	0.000	0.025	0.001	0.012	

MECHANICAL AND PHYSICAL PROPERTIES OF MATERIAL

* TC	HEAT TREATMENT	* L	Y S	UTS	ELONG.	R.A.	* L	TEMP	IMPACT CVN	HARDNESS
PR		T	PSI .2%	PSI	% IN 2"	%	T	F.	FT. LBS	HBW
PR			46200	79900	28.0	49.0				
			/	/	/	/				

* CHECKED ON => TC=TEST COUPON PR=PRODUCT AS DELIVERED. L=LONGITUDE. T=TRANSVER.

OTHER RESULTS

COMFORMS TO

A29/A29M-05

A105/A105M-02

REDUCTION RATIO

10.10 RED

MELTED COUNTRY

USA

ROLLED COUNTRY

USA

WE HEREBY CERTIFY THAT THE ABOVE DATA IS A TRUE COPY OF THE DATA FURNISHED US BY THE PRODUCING MILL OR SUPPLIER OR THE DATA RESULTING FROM TESTS PERFORMED IN APPROVED LABORATORIES.

WE CERTIFY THAT ABOVE MATERIALS CONFORMS TO THE REQUIREMENTS OF THE ABOVE SPECIFICATION(S).

E. O. & E.

encore-metals

Encore Metals
7470 Vantage Way
DELTA, B.C. V4G 1H1

CERTIFICATION OF ANALYSIS AND TESTS

ISO 9001
Certified

For:
ENCORE METALS INC
6925-8TH STREET NW
EDMONTON
CANADA, T6P-1T9

Date: 07/07/10
Your Order No. B100605
Our Invoice No. 186978
Our S.O. No. 130781
ID# 99
0000120995

Description of Material and Specifications

2.5" HR-RE A105K20'02"

Chemical Analysis

Heat M647022

C	Mn	P	S	Si	Ni	Cr	Mo	Al
.21	.88	.013	.025	.230	.11	.14	.032	.002
Cu	Ti	V	Co	Sn				
.31	.001	.026	.002	.009				

Mechanical Properties

Tensile	Yield	Elong	R.A.	D.I.
80000	51000	27% 2"	54	.88

KTSC..

RECEIVED JUL 15 2010

Certificate of Tests shall not be reproduced except in full. The material was not exposed to mercury or any metal alloy that is liquid at ambient temperature during processing or while in our possession. No weld or weld repair was performed on this material.
We hereby certify that the foregoing data is a true copy of the data furnished by our supplier or resulting from test performed for our company.

Director Metallurgy and Quality
John G. Asimou



CERTIFIED MILL TEST REPORT

BILL TO

SHIP TO

Date	09/29/2010	Customer PO	P9859-1-6702	Specifications
ASI Ord No.	38458	Customer PT.		SAE 1022
ASI Ord Line Item	1			ASTM A 572-06 GR50, ASTM A 29-05

Item Description

Steel Bar, Hot Rolled, 2:5000, 20' 2"

Strand Cast, RR = 9.98:1

Heat Number

109335

Yield PSI

56400

Tensile PSI

82800

% Elongation

24 in 2"

% ROA

42

Bend Test

CHEMICAL ANALYSIS TEST METHODS ASTM E-415 & E-1019

Heat Number	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	Al	Nb/Cb	V	B	Ti	N	Ca
109335	0.21	0.91	0.008	0.028	0.22	0.16	0.077	0.091	0.014	0.008	0.002	0.006	0.035	0.0002	0.0013	0.0109	0.0014

JOMINY HARDENABILITY USING ASTM A-255 CALCULATED FROM CHEMICAL DI

Heat Number GS DI

109335 8 0.76

SPECIAL TEST RESULTS

ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213	ASTM E 213
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Heat Number	TA	TB	TC	TD	HA	HB	HC	HD	S	O	S	O	S	R	C	A	B	RC	RB	EC
109335																				

ADDITIONAL COMMENTS

No mercury, lead, radium, or alpha containing material or equipment is used or deliberately added in the production of this steel. No weld or weld repairs were performed on this material. This Steel is 100% Electric Arc Furnace Melted and Rolled in the U.S.A. Material qualifies as NAFTA origination.

Subscribed and sworn to before me, a Notary Public, in and for the county of Madison, State of Illinois

this _____ Day of _____

My commission expires _____

(Notary Public)

Alteration or reproduction of this report, except in full, is not allowed without written approval by a representative of Alton Steel Incorporated.

I hereby certify that the above tests are correct as contained in the records of ALTON STEEL INCORPORATED

Quality Leader: Robert Cauley

R Cauley



IMW PRESSURE TEST REPORT

Test Standard

CSA B51

UNIT UNDER TEST (UUT) DATA		TEST REQUIREMENTS	
Work Order ID	53827	Type (media)	Hydrostatic (water)
Part ID	204097	Design Pressure (PSIG)	1200
Part Description	Scrubber Bottle	Test Pressure (PSIG)	1560
Sequence ID	30	(Approx. 107.56 BAR, 10755.82 kPa)	
Serial #	53827-5	Duration (minutes)	30
Drawing ID (incl Rev.)	204097 Rev C		

PRESSURE GAUGE(S) USED				
Serial #	Description	Range	Accuracy +/-	Cal. Due
PRIMARY				
IMW-538	Gauge, Pressure	0 to 5000 PSIG	50 PSIG	2011/11/05
SECONDARY (If Used)				
IMW-532	Gauge, Pressure	0 to 5000 PSIG	50 PSIG	2011/11/05

TEST DATA				
MDMT (see drawing)		Test Commenced On (YYYY/MM/DD)		2011/02/16
-20				
PART DESCRIPTION	HEAT NUMBER	PART DESCRIPTION	HEAT NUMBER	HT# VERIFICATION
Shell	0935581			All Heat Numbers Verified (Certs on File).
Top Cap	A100981			
Bottom Cap	MM09101507			
				Checked By: kgrist
Metal Temp (> MDMT +30 F)		WATER TEMP >70F (ASME SECT I)		
Test Commenced By	Mdunstan	Witnessed By	N/A	
Employee #	476	Employee #	N/A	
Test Steps	Target (PSIG)	Actual Readings (PSIG)		Time
		Primary Gauge	Secondary Gauge	
(1) Pressure On	1,560	1560	1560	10:30 PM
(2) Pressure Off	1,560	1560	1560	11:00 PM
Test Completed By	Mdunstan	Witnessed By	N/A	
Employee #	476	Employee #	N/A	

AI Acceptance (when req'd):

Date:

NOTES	
Welded by Kyle T	

RESULTS	
Pressure gauge(s) used were calibrated and traceable to National and/or International Standards.	
IMW hereby certifies the UUT stated above was tested with the following results:	
<ul style="list-style-type: none"> ✓ Valid Pressure Gauge(s) Used ✓ Heat Numbers Verified ✓ Test Pressure Attained ✓ Test Pressure Maintained ✓ Test Duration Attained ✓ Hydrostatic (water) Test Type Confirmed 	
<h1>PASS</h1>	
Report Completed By: Mdunstan Report Date: 2011/02/16	



IMW PRESSURE TEST REPORT

Test Standard

CSA B51

UNIT UNDER TEST (UUT) DATA		TEST REQUIREMENTS	
Work Order ID	53827	Type (media)	Hydrostatic (water)
Part ID	204097	Design Pressure (PSIG)	1200
Part Description	Scrubber Bottle	Test Pressure (PSIG)	1560
Sequence ID	30	(Approx. 107.56 BAR, 10755.82 kPa)	
Serial #	53827-9	Duration (minutes)	30
Drawing ID (incl Rev.)	204097 Rev C		

PRESSURE GAUGE(S) USED				
Serial #	Description	Range	Accuracy +/-	Cal. Due
PRIMARY				
IMW-010	Gauge, Pressure	0 to 3000 PSIG	15 PSIG	2011/06/28
SECONDARY (If Used)				
IMW-201	Gauge, Digital Pressure	0 to 3000 PSIG	15 PSIG	2011/07/22

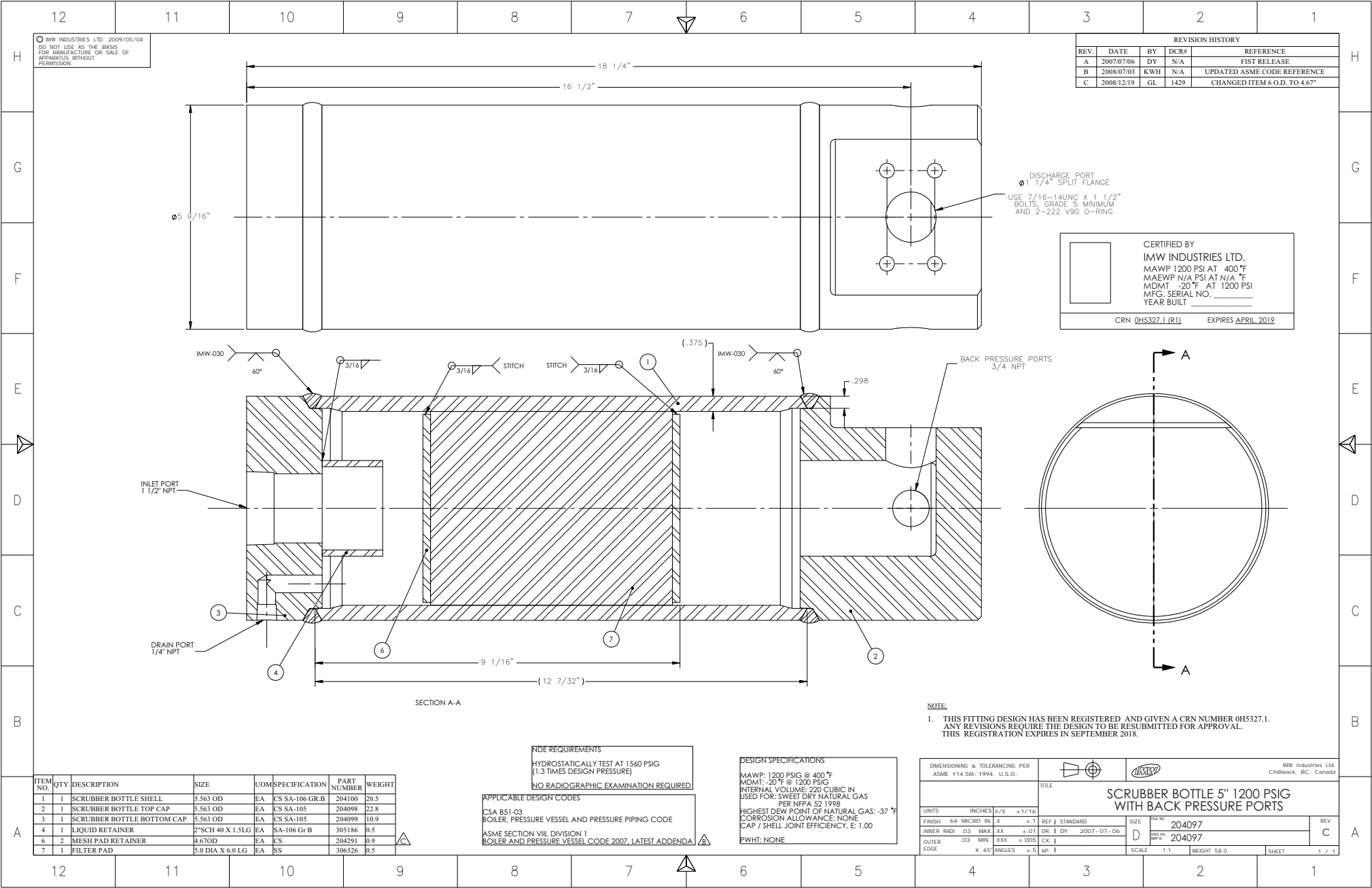
TEST DATA				
MDMT (see drawing)		Test Commenced On (YYYY/MM/DD)		2011/02/16
-20				
PART DESCRIPTION	HEAT NUMBER	PART DESCRIPTION	HEAT NUMBER	HT# VERIFICATION
Shell	0935581			All Heat Numbers Verified (Certs on File).
Top Cap	A100981			
Bottom Cap	A100981			
				Checked By: kgrist
Metal Temp (> MDMT +30 F)		WATER TEMP >70F (ASME SECT I)		
Test Commenced By	Chuesken	Witnessed By	Ken Grist	
Employee #	609	Employee #	128	
Test Steps	Target (PSIG)	Actual Readings (PSIG)		Time
		Primary Gauge	Secondary Gauge	
(1) Pressure On	1,560	1580	1570	12:55 PM
(2) Pressure Off	1,580	1580	1570	1:30 PM
Test Completed By	Chuesken	Witnessed By	Ken Grist	
Employee #	609	Employee #	128	

AI Acceptance (when req'd):

Date:

NOTES	
Welded by Kyle T	

RESULTS	
Pressure gauge(s) used were calibrated and traceable to National and/or International Standards.	
IMW hereby certifies the UUT stated above was tested with the following results:	
<ul style="list-style-type: none"> ✓ Valid Pressure Gauge(s) Used ✓ Heat Numbers Verified ✓ Test Pressure Attained ✓ Test Pressure Maintained ✓ Test Duration Attained ✓ Hydrostatic (water) Test Type Confirmed 	
<h1>PASS</h1>	
Report Completed By: kgrist	
Report Date: 2011/02/18	



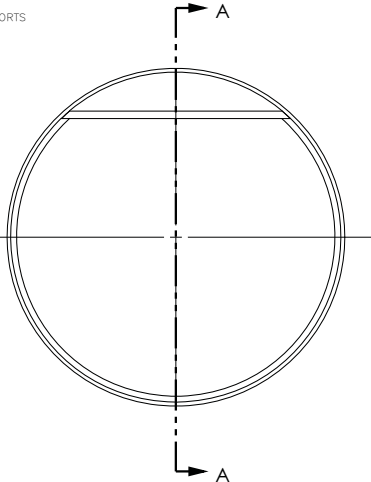
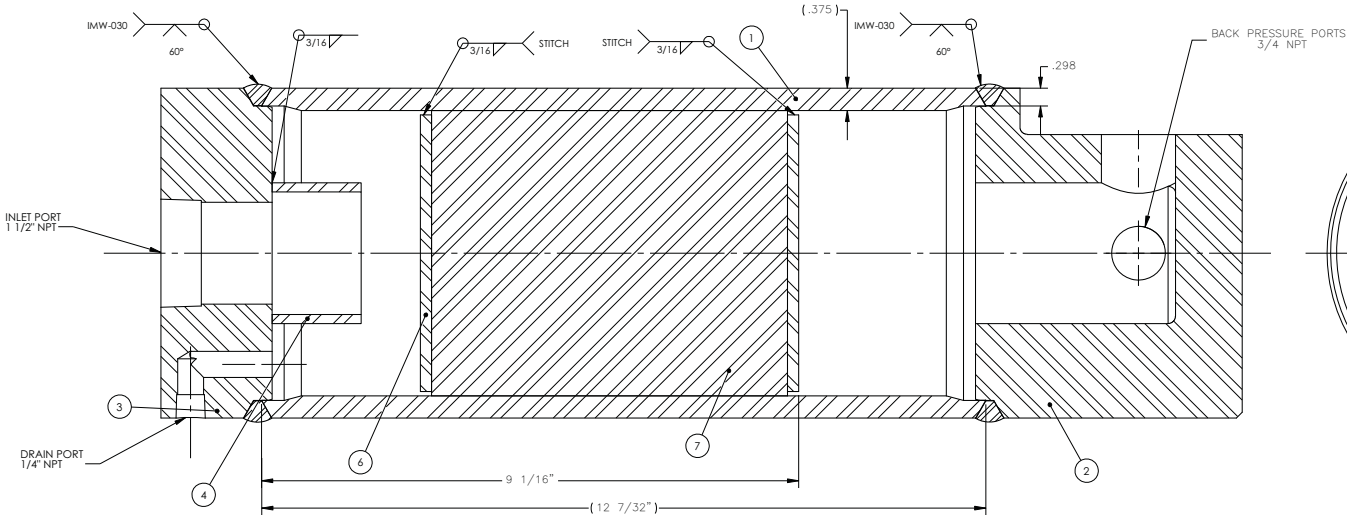
IMW INDUSTRIES LTD. 2009/05/04
DO NOT USE AS THE BASIS
FOR MANUFACTURE OR SALE OF
APPARATUS WITHOUT
PERMISSION

REVISION HISTORY				
REV.	DATE	BY	DCR#	REFERENCE
A	2007/07/06	DY	N/A	FIST RELEASE
B	2008/07/03	KWH	N/A	UPDATED ASME CODE REFERENCE
C	2008/12/19	GL	1429	CHANGED ITEM 6 O.D. TO 4.67"

DISCHARGE PORT
1 1/4" SPLIT FLANGE
USE 7/16-14UNC X 1 1/2"
BOLTS, GRADE 5 MINIMUM
AND 2-222 V90 O-RING

CERTIFIED BY
IMW INDUSTRIES LTD.
MAWP 1200 PSI AT 400°F
MAEWP N/A PSI AT N/A °F
MDMT -20°F AT 1200 PSI
MFG. SERIAL NO. _____
YEAR BUILT _____

CRN 0H5327.1 (R1) EXPIRES APRIL 2012



NOTE:
1. THIS FITTING DESIGN HAS BEEN REGISTERED AND GIVEN A CRN NUMBER 0H5327.1.
ANY REVISIONS REQUIRE THE DESIGN TO BE RESUBMITTED FOR APPROVAL.
THIS REGISTRATION EXPIRES IN SEPTEMBER 2018.

ITEM NO.	QTY	DESCRIPTION	SIZE	UOM	SPECIFICATION	PART NUMBER	WEIGHT
1	1	SCRUBBER BOTTLE SHELL	5.563 OD	EA	CS SA-106 GR.B	204100	20.5
2	1	SCRUBBER BOTTLE TOP CAP	5.563 OD	EA	CS SA-105	204098	22.8
3	1	SCRUBBER BOTTLE BOTTOM CAP	5.563 OD	EA	CS SA-105	204099	10.9
4	1	LIQUID RETAINER	2" SCH 40 X 1.5 LG	EA	SA-106 Gr B	305186	0.5
6	2	MESH PAD RETAINER	4.67 OD	EA	CS	204291	0.9
7	1	FILTER PAD	5.0 DIA X 6.0 LG	EA	SS	306526	0.5

DESIGN REQUIREMENTS
HYDROSTATICALLY TEST AT 1560 PSIG
(1.3 TIMES DESIGN PRESSURE)
NO RADIOGRAPHIC EXAMINATION REQUIRED

APPLICABLE DESIGN CODES
CSA B51-03
BOILER, PRESSURE VESSEL AND PRESSURE PIPING CODE
ASME SECTION VIII, DIVISION 1
BOILER AND PRESSURE VESSEL CODE 2007, LATEST ADDENDA

DESIGN SPECIFICATIONS
MAWP: 1200 PSIG @ 400 °F
MDMT: -20 °F @ 1200 PSIG
INTERNAL VOLUME: 220 CUBIC IN
USED FOR: SWEET DRY NATURAL GAS
PER NFPA 52 1998
HIGHEST DEW POINT OF NATURAL GAS: -37 °F
CORROSION ALLOWANCE: NONE
CAP / SHELL JOINT EFFICIENCY, E: 1.00
PWHT: NONE

DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994 U.S.O.				IMW Industries Ltd. Chilliwack, BC, Canada			
UNITS: INCHES X.X ±.1/16				TITLE: SCRUBBER BOTTLE 5" 1200 PSIG WITH BACK PRESSURE PORTS			
FINISH: 64 MICRO IN	X	±.1	REF: STANDARD	SIZE: D	FILE NO: 204097	REV: C	
INNER RADI: .03 MAX	XX	±.01	DR: I DY 2007-07-06	SIZE: D	FILE NO: 204097	REV: C	
OUTER EDGE: .03 MIN	XXX	±.005	CK: I	SCALE: 1:1	WEIGHT: 58.0	SHEET: 1 / 1	
ANGLES: ±.5							



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Contract No: 2210001455

HENGYANG VALIN STEEL TUBE CO., LTD

Customer:

MILL TEST REPORTS

Add: 10 Dalixincun, Hengyang City, Hunan, China

Tel and Fax: +86 734 8873739 8872942

Cable: 6993

P.C. 421001

DESCRIPTION: PRIME SEAMLESS STEEL PIPES

Date: NOV 09,2009

TOTAL: 466 PIECES, 57 BUNDLES, 89.917 MT

Page: 1/1

SPEC: API 5L-B PSL-1/ASTM A 106B/A 53B/ASME SA106B/SA 53B,NACE MR-01-75 (LATEST VERSION)

CERTIFICATE NO: 09-02-1115

NO	BATCH NO	HEAT NO	STEEL GRADE	SIZE	BUNDLES	PIECES	FEET	THEORETICAL WEIGHT(MT)	ACTUAL WEIGHT(MT)
1	JX1019081	0935244	B	5"*.258"*.21FT	6	56	1176	7.806	
1	JX1019082	0935244	B	5"*.258"*.21FT	10	99	2079	13.8	
2	JX1019090	0935581	B	5"*.375"*.21FT	11	110	2310	21.78	
3	JX1019011	0935581	B	6"*.280"*.21FT	7	44	924	7.964	
3	JX1019012	0935581	B	6"*.280"*.21FT	7	48	1008	8.688	
3	JX3019150	0935581	B	6"*.280"*.21FT	7	47	987	8.507	
4	JX3019141	0935244	B	6"*.280"*.40FT	9	62	2480	21.372	
total					57	466	10964	89.917	

NO	DELIVERY CONDITION	NONDESTRUCTIVE TEST		CHEMICAL COMPOSITION %													
		EMI	U.T	TYPE	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Ti	Nb	
1	HOT-ROLLED	OK	N/A	P	0.18	0.20	0.35	0.010	0.003	0.15	0.05	0.04	0.01	0.01	0.002	0.001	
				P	0.18	0.20	0.35	0.010	0.003	0.15	0.05	0.04	0.01	0.01	0.002	0.001	
				L	0.21	0.25	0.40	0.010	0.003	0.10	0.03	0.06	0.02	0.01	0.004	0.005	
1	HOT-ROLLED	OK	N/A	P	0.18	0.24	0.40	0.007	0.004	0.09	0.02	0.05	0.02	0.01	0.004	0.001	
				P	0.18	0.25	0.40	0.007	0.004	0.09	0.02	0.06	0.02	0.01	0.004	0.001	
				L	0.21	0.25	0.40	0.010	0.003	0.10	0.03	0.06	0.02	0.01	0.004	0.005	
2	HOT-ROLLED	OK	N/A	P	0.18	0.23	0.38	0.007	0.002	0.09	0.03	0.05	0.02	0.01	0.002	0.001	
				P	0.18	0.24	0.38	0.007	0.002	0.09	0.03	0.05	0.02	0.01	0.002	0.001	
				L	0.21	0.31	0.40	0.008	0.004	0.09	0.03	0.03	0.02	0.01	0.002	0.001	
3	HOT-ROLLED	OK	N/A	P	0.18	0.23	0.37	0.007	0.003	0.09	0.03	0.03	0.02	0.01	0.002	0.001	
				P	0.19	0.24	0.36	0.007	0.003	0.09	0.03	0.03	0.02	0.01	0.002	0.001	
				L	0.21	0.31	0.40	0.008	0.004	0.09	0.03	0.03	0.02	0.01	0.002	0.001	
3	HOT-ROLLED	OK	N/A	P	0.19	0.24	0.36	0.007	0.003	0.09	0.03	0.05	0.02	0.01	0.002	0.001	
				P	0.18	0.23	0.37	0.007	0.003	0.09	0.03	0.05	0.02	0.01	0.002	0.001	
				L	0.21	0.31	0.40	0.008	0.004	0.09	0.03	0.03	0.02	0.01	0.002	0.001	
3	HOT-ROLLED	OK	N/A	P	0.19	0.24	0.36	0.006	0.004	0.09	0.03	0.03	0.02	0.01	0.002	0.001	
				P	0.18	0.23	0.37	0.006	0.004	0.09	0.03	0.03	0.02	0.01	0.002	0.001	
				L	0.21	0.31	0.40	0.008	0.004	0.09	0.03	0.03	0.02	0.01	0.002	0.001	
4	HOT-ROLLED	OK	N/A	P	0.21	0.30	0.39	0.006	0.004	0.09	0.03	0.03	0.02	0.01	0.002	0.001	
				P	0.20	0.31	0.38	0.006	0.004	0.09	0.03	0.03	0.02	0.01	0.002	0.001	
				L	0.21	0.25	0.40	0.010	0.003	0.10	0.03	0.06	0.02	0.01	0.004	0.005	

NO	TENSILE STRENGTH b (Psi)	YIELD STRENGTH s (Psi)	ELONGATION δ (%)	Ak (J)	IMPACT	HARDNESS HRC≤22	HYDROSTATIC TEST (Psi)	FLATTEN TEST	BEND TEST
	strip, L, bo=25, Lo=50mm			SIZE	AK Ori/Tem				
1	65250	48575	38.5		N/A	OK	1950	OK	N/A
1	68150	50025	40		N/A	OK	1950	OK	N/A
2	63800	42775	47.5		N/A	OK	2800	OK	N/A
3	68875	50025	40		N/A	OK	1780	OK	N/A
3	71050	52925	40.6		N/A	OK	1780	OK	N/A
3	69600	51475	42		N/A	OK	1780	OK	N/A
4	72500	62925	36.6		N/A	OK	1780	OK	N/A

REMARKS: 1. We hereby certify that this certificate of quality is issued and signed by the manufacturer.

2. We hereby certify that the properties described herein meet the requirement of the above spec.

3. We hereby certify that this certificate is issued accordance with EN10204 3.1.B.

4. Hardness certified to NACE MR-0175.

5. TYPE: R-P-Product analysis L-Ladle analysis;

QUALITY MANAGER:





JADE-STERLING STEEL CO., INC.

2300 East Aurora Road, Twinsburg, Ohio 44087

CERTIFICATION OF ANALYSIS AND TESTS

ISO 9001
Certified

For:
ENCORE METALS INC
6925-8TH STREET NW
EDMONTON
CANADA, T6P-1T9

Date 11/09/10
Your Order No. 8100904
Our Invoice No. 188805
Our S.O. No. 132297
ID# 02
0000126225

Description of Material and Specifications

6" HR RD A105X15/16"

Chemical Analysis

Heat	C	Mn	P	S	Si	Ni	Cr	Mo	Al
A100981	.24	.64	.008	.019	.240	.06	.10	.020	.023
Cu	B	Ti	V	Pb	Cb	Sn	Bi	N	
.17	.0000	.001	.001	.001	.001	.008	.000	.0073	

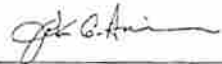
Revision from our INV/SO 188805 ID# 99

Mechanical Properties

Tensile	Yield	%Elong	%R.A.	Hardness
70 KSI	37 KSI	33.5-2"	55	131 BHN

Misc:

Certificate of Tests shall not be reproduced except in full. The material was not exposed to mercury or any metal alloy that is liquid at ambient temperature during processing or while in our possession. No weld or weld repair was performed on this material.
We hereby certify that the foregoing data is a true copy of the data furnished by our supplier or resulting from tests performed for our company.


Director/Metallurgy and Quality
John G. Asimou

CERTIFICATE OF ANALYSIS & TESTS

ENCORE METALS
7470 VANTAGE WAY
DELTA, BC V4G 1H1

DATE: 10/15/10
CUSTOMER PO #: B100850
CUSTOMER PART #:

DESCRIPTION

HEAT NO: MM09101507
MILL: NUCOR
QTY: 1 PC.
SIZE: 6"OD X 42"LG

GRADE: ASTM A350 LF-2/A-105
SPEC.: ASTM A350 LF-2/A-105
NACE MR01-75; BS EN10204.3.1
FINISH: NORMALIZED

CHEMICAL PROPERTIES

C.	Mn.	P.	S.	Si.	Ni.	Cr.	Mo.	Cu.
.19 /	1.11 /	.006 /	.014 /	.16 /	.07 /	.09 /	.020 /	.19 /
Al.	V.	Nb.	Sn.	N.				
.036	.050 /	<.002	.008					

MECHANICAL PROPERTIES

YIELD ST.: 50,000 /
TENSILE ST.: 76,750 /
EL %: 24 /
RED OF AREA: 67 /
HARDNESS: 156-156 HBW
GRAIN:

CHARPIES: -50 DEG. F LCVN 49/64/62 FT./LBS.
LATERAL EXPANSION: 26/27/27
SHEAR FRACTURE: 20/20/20
Unless otherwise stated, specimens are full size: 10mm x 10 mm

CE=.42

HEAT TREATMENT

PRODUCT:
NORMALIZED AT 1650 DEG F FOR 4.00 HOURS, AIR COOLED

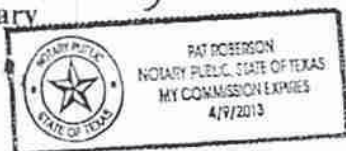
TEST BAR: Size: 3.25" X 6"LG

HARDNESS: 163-163 HBW (CKED IN 2 PLACES)

Unless otherwise stated, yield stress is .2% stress is .2% offset. Gauge length is 2" for 1/2" specimen or 1" for 1/4" specimen.

Sworn & Subscribed before me this
15TH Day of October, 2010

Pat Robertson
Notary



We hereby certify that the above is the same as
the data furnished us by our suppliers or resulting
from tests performed in a recognized laboratory.

By *Julia Kauluski*
Representative



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IMW PRESSURE TEST REPORT

Test Standard

CSA B51

UNIT UNDER TEST (UUT) DATA		TEST REQUIREMENTS	
Work Order ID	54304	Type (media)	Hydrostatic (water)
Part ID	204110	Design Pressure (PSIG)	3000
Part Description	Scrubber Bottle	Test Pressure (PSIG)	3900
Sequence ID	30	(Approx. 268.9 BAR, 26889.56 kPa)	
Serial #	54304-1	Duration (minutes)	30
Drawing ID (incl Rev.)	204110 Rev D		

PRESSURE GAUGE(S) USED				
Serial #	Description	Range	Accuracy +/-	Cal. Due
PRIMARY				
IMW-427	Gauge, Digital Pressure	0 to 7500 PSIG	37.5 PSIG	2011/04/20
SECONDARY (If Used)				
IMW-428	Gauge, Digital Pressure	0 to 7500 PSIG	37.5 PSIG	2011/04/20

TEST DATA				
MDMT (see drawing)		Test Commenced On (YYYY/MM/DD)		2011/02/22
-20				
PART DESCRIPTION	HEAT NUMBER	PART DESCRIPTION	HEAT NUMBER	HT# VERIFICATION
Shell	0921911			All Heat Numbers Verified (Certs on File).
Top Cap	A073744			
Bottom Cap	A064003			
				Checked By: Mlavigne
Metal Temp (> MDMT +30 F)		WATER TEMP >70F (ASME SECT I)		
Test Commenced By	Mlavigne	Witnessed By	NA	
Employee #	523	Employee #	NA	
Test Steps	Target (PSIG)	Actual Readings (PSIG)		Time
		Primary Gauge	Secondary Gauge	
(1) Pressure On	3,900	3959	3962	2:00 PM
(2) Pressure Off	3,959	3959	3962	2:30 PM
Test Completed By	Mlavigne	Witnessed By	NA	
Employee #	523	Employee #	NA	

AI Acceptance (when req'd):

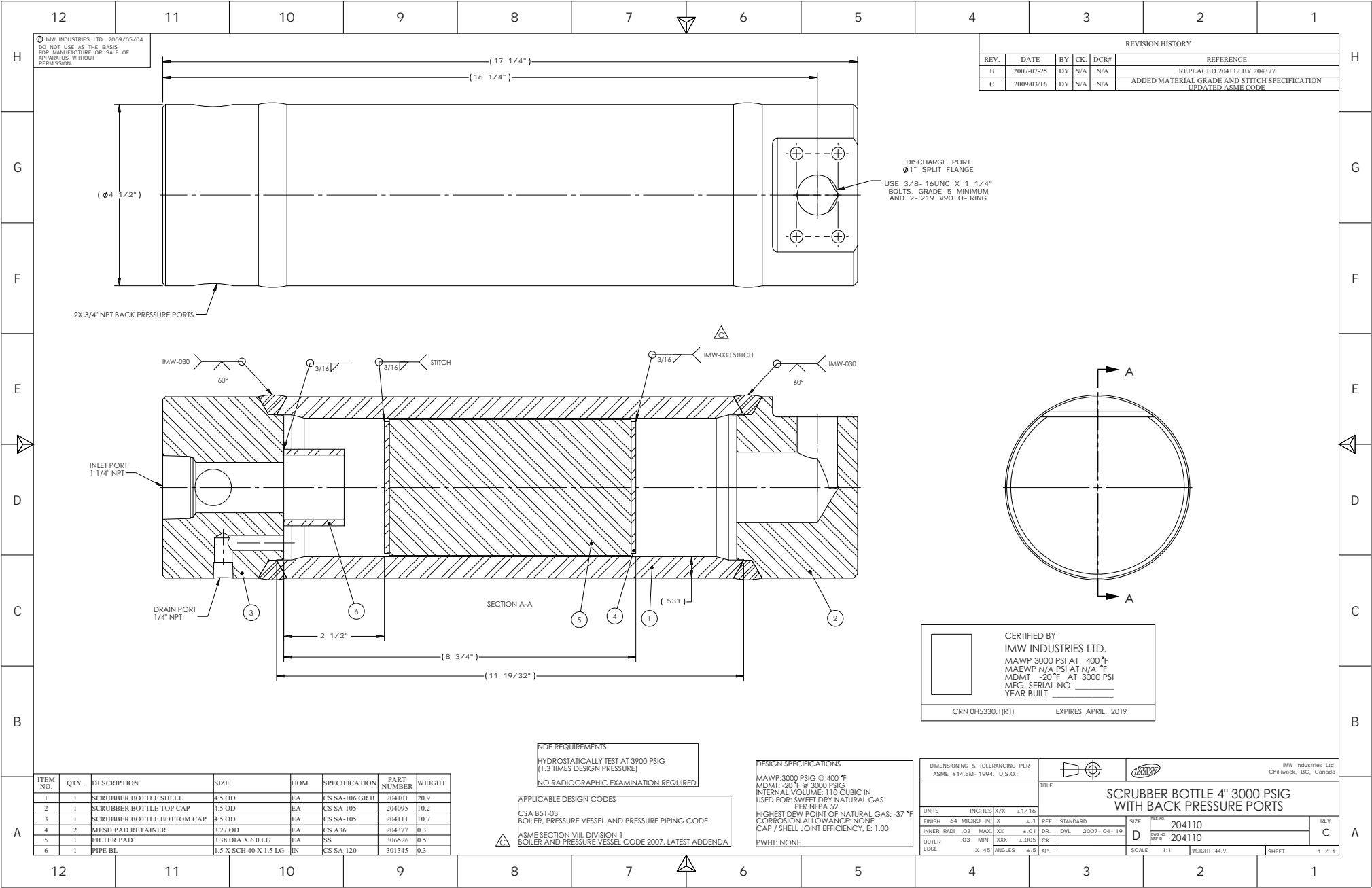
Date:

NOTES	
Welded by Kyle T	

RESULTS	
Pressure gauge(s) used were calibrated and traceable to National and/or International Standards.	
IMW hereby certifies the UUT stated above was tested with the following results:	
<ul style="list-style-type: none"> ✓ Valid Pressure Gauge(s) Used ✓ Heat Numbers Verified ✓ Test Pressure Attained ✓ Test Pressure Maintained ✓ Test Duration Attained ✓ Hydrostatic (water) Test Type Confirmed 	
<h1>PASS</h1>	
Report Completed By: Mlavigne Report Date: 2011/02/22	



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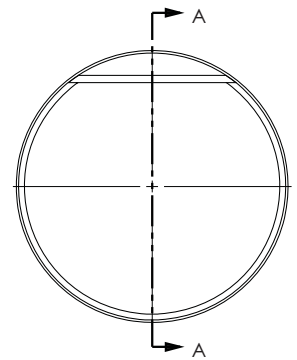


IMW INDUSTRIES LTD. 2009/05/04
DO NOT USE AS THE BASIS
FOR MANUFACTURE OR SALE OF
APPARATUS WITHOUT
PERMISSION

REVISION HISTORY				
REV.	DATE	BY	CHK.	DCR#
B	2007-07-25	DY	N/A	N/A
C	2009/03/16	DY	N/A	N/A

REFERENCE	
REPLACED 204112 BY 204377	
ADDED MATERIAL GRADE AND STITCH SPECIFICATION UPDATED ASME CODE	

DISCHARGE PORT
Ø1" SPLIT FLANGE
USE 3/8-16UNC X 1 1/4"
BOLTS, GRADE 5 MINIMUM
AND 2-219 V90 O-RING



CERTIFIED BY
IMW INDUSTRIES LTD.
MAWP 3000 PSI AT 400 °F
MAEWP N/A PSI AT N/A °F
MDMT -20 °F AT 3000 PSI
MFG. SERIAL NO. _____
YEAR BUILT _____
CRN 0H5330.1(R1) EXPIRES APRIL 2019.

ITEM NO.	QTY.	DESCRIPTION	SIZE	UOM	SPECIFICATION	PART NUMBER	WEIGHT
1	1	SCRUBBER BOTTLE SHELL	4.5 OD	EA	CS SA-106 GR.B	204101	20.9
2	1	SCRUBBER BOTTLE TOP CAP	4.5 OD	EA	CS SA-105	204095	10.2
3	1	SCRUBBER BOTTLE BOTTOM CAP	4.5 OD	EA	CS SA-105	204111	10.7
4	2	MESH PAD RETAINER	3.27 OD	EA	CS A36	204377	0.3
5	1	FILTER PAD	3.38 DIA X 6.0 LG	EA	SS	306526	0.5
6	1	PIPE BL	1.5 X SCH 40 X 1.5 LG	IN	CS SA-120	301345	0.3

NOTE REQUIREMENTS
HYDROSTATICALLY TEST AT 3900 PSIG
(1.3 TIMES DESIGN PRESSURE)
NO RADIOGRAPHIC EXAMINATION REQUIRED

APPLICABLE DESIGN CODES
CSA B51-03
BOILER, PRESSURE VESSEL AND PRESSURE PIPING CODE
ASME SECTION VIII, DIVISION 1
BOILER AND PRESSURE VESSEL CODE 2007, LATEST ADDENDA

DESIGN SPECIFICATIONS
MAWP: 3000 PSIG @ 400 °F
MDMT: -20 °F @ 3000 PSIG
INTERNAL VOLUME: 110 CUBIC IN
USED FOR: SWEET DRY NATURAL GAS
PER NFPA 52
HIGHEST DEW POINT OF NATURAL GAS: -37 °F
CORROSION ALLOWANCE: NONE
CAP / SHELL JOINT EFFICIENCY, E: 1.00
PWHT: NONE

DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994 U.S.O.				IMW Industries Ltd. Chilliwack, BC, Canada	
TOLERANCES UNLESS OTHERWISE SPECIFIED				TITLE SCRUBBER BOTTLE 4" 3000 PSIG WITH BACK PRESSURE PORTS	
UNITS	INCHES	MM	±	SIZE	FILE NO.
FINISH	64 MICRO IN	XX	±.1	REF. I STANDARD	204110
INNER RADI	.03 MAX	XX	±.01	DR. I DVL 2007-04-19	204110
OUTER EDGE	.03 MIN	XXX	±.005	CK. I	204110
X 45 ANGLES ±.5 AP. I				SCALE	1:1
				WEIGHT	44.9
				SHEET	1 / 1



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Contract No: 2110000931

HENGYANG VALIN STEEL TUBE CO., LTD

Add: 10 Dalixincun, Hengyang City, Hunan, China

Customer: R AND R TRADING CO.,LTD.

MILL TEST CERTIFICATE

Tel and Fax: +86 734 8873739 8872942

PO.NO.:401792

Cable: 6993

DESCRIPTION: PRIME SEAMLESS STEEL PIPE

Date: APR 01, 2009

P.C. 421001

TOTAL: 7446PIECES, 379BUNDLES, 730.543MT

Page: 5/6

SPEC: API 5L-B/ASTM A53B/ASME A106-B/SA53-B

CERTIFICATE NO: 09-03-0401

NO.	BATCH NO.	HEAT NO.	STEEL GRADE	SIZE	BUNDLES	PIECES	FEET	THEORETICAL WEIGHT (MT)	ACTUAL WEIGHT(MT)
25	992202525	0921780	B	4"*.438"*.21FT	9	90	1890	16.308	N/A
26	892300382	0921911	B	4"*.531"*.21FT	8	73	1533	15.666	N/A
27	892300383	0910390	B	4"*.674"*.21FT	9	62	1302	16.28	N/A
27	892300384	0921912	B	4"*.674"*.21FT	3	21	441	5.514	N/A
28	892100375	0910391	B	5"*.5"*.21FT	6	39	819	10.056	N/A
29	892100376	0910261	B	5"*.625"*.21FT	6	34	714	10.685	N/A
30	892300377	0910392	B	5"*.75"*.21FT	4	26	546	9.557	N/A
30	892300378	0910394	B	5"*.75"*.21FT	7	48	1008	17.644	N/A
31	892300361	0921454	B	6"*.562"*.21FT	5	34	714	11.798	N/A
31	892300362	0921455	B	6"*.562"*.21FT	3	20	420	6.94	N/A
TOTAL					59	447	9387	120.449	N/A

NO	DELIVERY CONDITION	NONDESTRUCTIVE TEST		CHEMICAL COMPOSITION %												
		ET	UT	TYPE	C	SI	Mn	P	S	Cu	Ni	Cr	Mo	V	Ti	Nb
25	HOT-ROLLED	OK	N/A	P	0.19	0.22	0.40	0.015	0.006	0.08	0.03	0.04	0.02	0.01	0.002	0.001
26	HOT-ROLLED	OK	N/A	P	0.19	0.22	0.40	0.015	0.006	0.08	0.03	0.04	0.02	0.01	0.005	0.001
27	HOT-ROLLED	OK	N/A	P	0.21	0.22	0.41	0.010	0.006	0.08	0.03	0.04	0.02	0.01	0.003	0.001
27	HOT-ROLLED	OK	N/A	P	0.20	0.29	0.41	0.011	0.005	0.09	0.04	0.04	0.03	0.01	0.004	0.001
27	HOT-ROLLED	OK	N/A	P	0.20	0.30	0.42	0.011	0.005	0.09	0.04	0.04	0.03	0.01	0.004	0.001
28	HOT-ROLLED	N/A	OK	P	0.21	0.19	0.42	0.011	0.007	0.09	0.03	0.03	0.02	0.01	0.003	0.001
29	HOT-ROLLED	N/A	OK	P	0.20	0.23	0.41	0.008	0.007	0.09	0.03	0.03	0.02	0.01	0.003	0.001
30	HOT-ROLLED	N/A	OK	P	0.21	0.20	0.43	0.013	0.009	0.09	0.03	0.03	0.02	0.01	0.003	0.001
30	HOT-ROLLED	N/A	OK	P	0.21	0.20	0.43	0.013	0.009	0.09	0.03	0.03	0.02	0.01	0.003	0.001
31	HOT-ROLLED	N/A	OK	P	0.20	0.21	0.45	0.007	0.007	0.10	0.04	0.04	0.02	0.01	0.002	0.001
31	HOT-ROLLED	N/A	OK	P	0.22	0.21	0.45	0.007	0.006	0.10	0.04	0.03	0.02	0.01	0.002	0.001

NO	TENSILE STRENGTH σb (PSI)	YIELD STRENGTH σs (PSI)	ELONGATION δ (%)	IMPACT		HARDNESS	HYDROSTATIC TEST (PSI)	FLATTEN TEST	BEND TEST
				Ak (J)	Or/Tem				
25	69600	46400	34.5	N/A		HRC 1.0	2800	OK	N/A
26	71775	47125	31.5	N/A		HRC 1.0	2800	OK	N/A
27	68150	43500	46	N/A		HRC 1.0	2800	OK	N/A
27	68875	44225	39.5	N/A		HRC 1.0	2800	OK	N/A
28	70325	44950	31	N/A		HRC 1.0	2800	OK	N/A
29	71050	45675	32.5	N/A		HRC 1.5	2800	OK	N/A
30	70325	45675	31	N/A		HRC 1.0	2800	OK	N/A
30	71775	47125	31.5	N/A		HRC 1.0	2800	OK	N/A
31	70325	48575	33	N/A		HRC 1.5	2800	OK	N/A
31	69600	47850	34	N/A		HRC 1.5	2800	OK	N/A

REMARKS: 1. We hereby certify that the material has been manufactured, sampled, tested and inspected to comply with the following standards:

2. Properties compliance to EN10204 3.1B.

3. BRINELL /Rockwell hardness certified to NACE MR-0175.

4. TYPE:P-Product analysis L-Ladle analysis;



QUALITY MANAGER:

Liu Zhi

04/10/2007



VANGUARD STEEL LTD.
7880 FRASER PARK DR.
BURNABY B.C.
V5J 5L8

PHONE: (604)- 294-3191

FAX: (604)- 294-8845

TEST REPORT

AISI RD A105 CHEM

HARMONIC MACHINE
P/O - 704
S/O - V57850

SIZE: 4-3/4"
HEAT # A073744
WORKS# 118935

DEL SLIP #

CHEMICAL COMPOSITION %

C	Mn	P.	S.	Si.	Ni.	Cr.	Mo.	Al.	Cu.	B	Ti	V	PB	CB
.25	.77	.007	.019	.290	.07	.09	.040	.020	.16	.0001	.001	.003	.000	.003
SN	BI	N												
.007		.0036												

MECHANICAL AND PHYSICAL PROPERTIES OF MATERIAL

* TC PR PR	HEAT TREATMENT	* L T	Y S PSI .2%	UTS PSI	ELONG. % IN 2"	R.A. %	* L T	TEMP F.	IMPACT CVN FT. LBS	HARDNESS BHN.
										149

* CHECKED ON => TC=TEST COUPON PR=PRODUCT AS DELIVERED. L=LONGITUDE. T=TRANSVER.

OTHER RESULTS

COMFORMS TO

ESTIMATED MECH PROPERTIES

GRAIN SIZE

7

WE HEREBY CERTIFY THAT THE ABOVE DATA IS A TRUE COPY OF THE DATA FURNISHED US BY THE PRODUCING MILL OR SUPPLIER OR THE DATA RESULTING FROM TESTS PERFORMED IN APPROVED LABORATORIES.

WE CERTIFY THAT ABOVE MATERIALS CONFORMS TO THE REQUIREMENTS OF THE ABOVE SPECIFICATION(S).

E. O. & E.

ENCORE METALS
DELTA, BC

FOR:
ENCORE METALS INC
7470 VANTAGE WAY
DELTA BC
CANADA, V4G 1H1

DATE PRINTED 11/01/07
YOUR ORDER NO. 43223
OUR INVOICE NO. 000000
OUR S.O. NO. 119535
ID# 01

0000076051

Description of Material and Specifications

4.625" HR RD A105X19/21'

Chemical Analysis

HEAT A064003	C ✓ .28	MN ✓ .71	P ✓ .008	S ✓ .026	SI ✓ .250	NI ✓ .08	CR ✓ .11	MO ✓ .060	AL .028	CU ✓ .20
	B .0003	TI .001	V ✓ .001	PB .002	CB .001	SN .010	BI	N .0071		

CONFORMS TO:

Mechanical Properties

TENSILE 80800 ✓	YIELD 44800 ✓	ELONG% 26-2" ✓	R.O.A% 54.2	HARDNESS 156 HBW	CE	D.I.	GR.SIZE
--------------------	------------------	-------------------	----------------	---------------------	----	------	---------

IMPACT:

Hardenability Data

HARDENABILITY EXPRESSED IN 16THS

1 2 3 4 5 6 7 8 9 10 12 14 16 18 20 22 24 26 28 30 32

MISC:

EM APPROVED

BY:



We hereby certify that the foregoing data is a true copy of the data furnished
by our supplier or resulting from tests performed in a recognized laboratory.

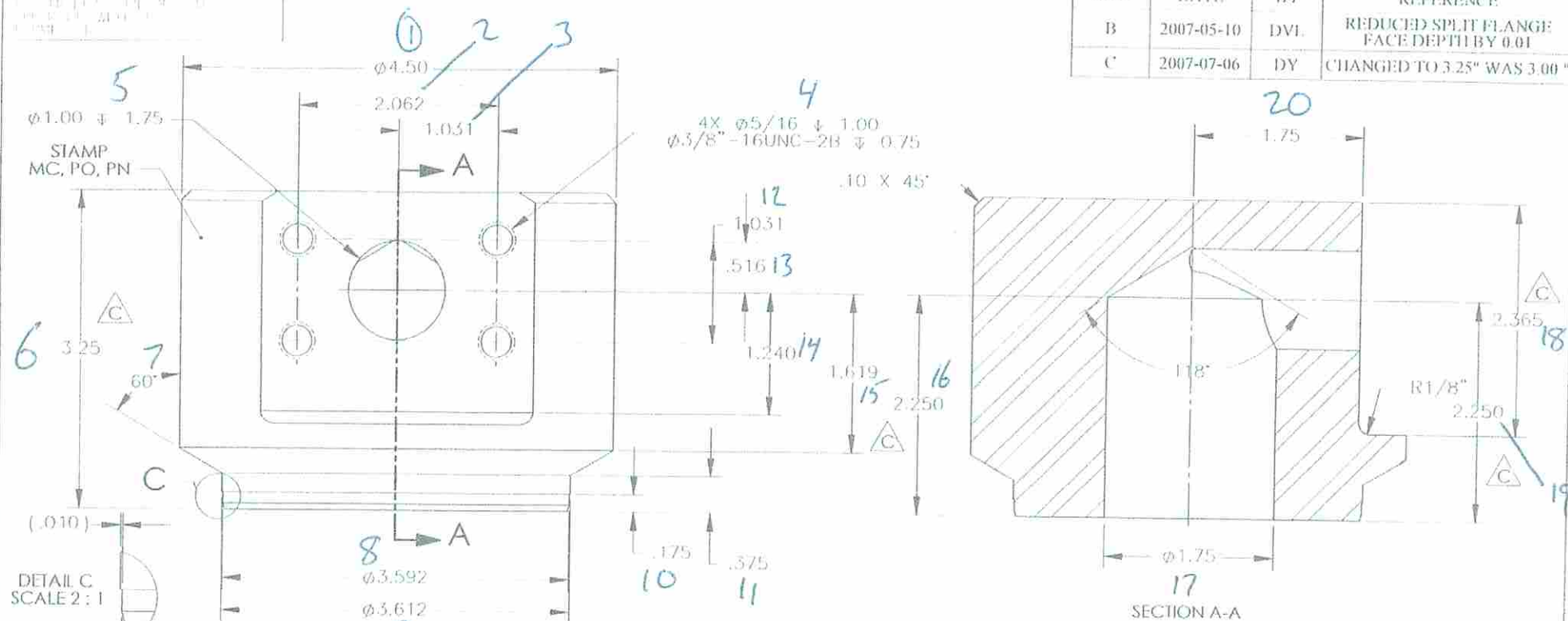


David R. Grimes

Quality Assurance Manager
David R. Grimes

© IMW 2007
 1. 100% INSPECTION
 2. 100% INSPECTION
 3. 100% INSPECTION
 4. 100% INSPECTION
 5. 100% INSPECTION
 6. 100% INSPECTION
 7. 100% INSPECTION
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 16. 100% INSPECTION
 17. 100% INSPECTION
 18. 100% INSPECTION
 19. 100% INSPECTION
 20. 100% INSPECTION

REVISION HISTORY			
REV.	DATE	BY	REFERENCE
B	2007-05-10	DVI	REDUCED SPLIT FLANGE FACE DEPTH BY 0.01
C	2007-07-06	DY	CHANGED TO 3.25" WAS 3.00"



NOTES:

1. THIS IS A PRESSURE FITTING. IMW'S QUALITY PLAN FOR THE MANUFACTURE OF PRESSURE FITTINGS APPLIES. RATINGS AND TEST REQUIREMENTS ARE SPECIFIED AT THE ASSEMBLY LEVEL.
2. STAMP MATERIAL CERTIFICATE (MC), PURCHASE ORDER (PO) AND PART (PN) NUMBERS AS SHOWN.

QTY	DESC.	SIZE	UOM	SPEC.	MATERIAL MRP ID
1	BAR RD	4.5 DIA X 3.125 LG	IN	CS SA-105	311705

IMW 2007
 1. 100% INSPECTION
 2. 100% INSPECTION
 3. 100% INSPECTION
 4. 100% INSPECTION
 5. 100% INSPECTION
 6. 100% INSPECTION
 7. 100% INSPECTION
 8. 100% INSPECTION
 9. 100% INSPECTION
 10. 100% INSPECTION
 11. 100% INSPECTION
 12. 100% INSPECTION
 13. 100% INSPECTION
 14. 100% INSPECTION
 15. 100% INSPECTION
 16. 100% INSPECTION
 17. 100% INSPECTION
 18. 100% INSPECTION
 19. 100% INSPECTION
 20. 100% INSPECTION



IMW 2007
 1. 100% INSPECTION
 2. 100% INSPECTION
 3. 100% INSPECTION
 4. 100% INSPECTION
 5. 100% INSPECTION
 6. 100% INSPECTION
 7. 100% INSPECTION
 8. 100% INSPECTION
 9. 100% INSPECTION
 10. 100% INSPECTION
 11. 100% INSPECTION
 12. 100% INSPECTION
 13. 100% INSPECTION
 14. 100% INSPECTION
 15. 100% INSPECTION
 16. 100% INSPECTION
 17. 100% INSPECTION
 18. 100% INSPECTION
 19. 100% INSPECTION
 20. 100% INSPECTION

SCRUBBER BOTTLE TOP CAP

4"

REV. B		204095	C
REV. C		204095	



IMW PRESSURE TEST REPORT

Test Standard

CSA B51

UNIT UNDER TEST (UUT) DATA		TEST REQUIREMENTS	
Work Order ID	50382	Type (media)	Hydrostatic (water)
Part ID	205105	Design Pressure (PSIG)	5500
Part Description	Pulsation Bottle	Test Pressure (PSIG)	7150
Sequence ID	20	(Approx. 492.98 BAR, 49297.53 kPa)	
Serial #	50382-6	Duration (minutes)	30
Drawing ID (incl Rev.)	205105 Rev C		

PRESSURE GAUGE(S) USED				
Serial #	Description	Range	Accuracy +/-	Cal. Due
PRIMARY				
IMW-537	Gauge, Pressure	0 to 15000 PSIG	150 PSIG	2011/10/22
SECONDARY (If Used)				
IMW-536	Gauge, Pressure	0 to 15000 PSIG	150 PSIG	2011/10/22

TEST DATA				
MDMT (see drawing)		Test Commenced On (YYYY/MM/DD)		2011/01/05
-20				
PART DESCRIPTION	HEAT NUMBER	PART DESCRIPTION	HEAT NUMBER	HT# VERIFICATION
Shell	90448			All Heat Numbers Verified (Certs on File).
Head	G8133			
Drain	G7491			
				Checked By: kgrist
Metal Temp (> MDMT +30 F)		WATER TEMP >70F (ASME SECT I)		
Test Commenced By	Wbishop	Witnessed By	Ken Grist	
Employee #	529	Employee #	128	
Test Steps	Target (PSIG)	Actual Readings (PSIG)		Time
		Primary Gauge	Secondary Gauge	
(1) Pressure On	7,150	7200	7300	7:21 AM
(2) Pressure Off	7,200	7200	7300	8:00 AM
Test Completed By	Wbishop	Witnessed By	Ken Grist	
Employee #	529	Employee #	128	

AI Acceptance (when req'd):

Date:

NOTES	
Welded by Kyle Thorburn	

RESULTS	
Pressure gauge(s) used were calibrated and traceable to National and/or International Standards.	
IMW hereby certifies the UUT stated above was tested with the following results:	
<ul style="list-style-type: none">✓ Valid Pressure Gauge(s) Used✓ Heat Numbers Verified✓ Test Pressure Attained✓ Test Pressure Maintained✓ Test Duration Attained✓ Hydrostatic (water) Test Type Confirmed	
PASS	
Report Completed By: kgrist	
Report Date: 2011/01/05	



IMW PRESSURE TEST REPORT

Test Standard

CSA B51

UNIT UNDER TEST (UUT) DATA		TEST REQUIREMENTS	
Work Order ID	52300	Type (media)	Hydrostatic (water)
Part ID	205105	Design Pressure (PSIG)	5500
Part Description	Pulsation Bottle	Test Pressure (PSIG)	7150
Sequence ID	20	(Approx. 492.98 BAR, 49297.53 kPa)	
Serial #	52300-1	Duration (minutes)	30
Drawing ID (incl Rev.)	205105 Rev C		

PRESSURE GAUGE(S) USED				
Serial #	Description	Range	Accuracy +/-	Cal. Due
PRIMARY				
IMW-536	Gauge, Pressure	0 to 15000 PSIG	150 PSIG	2011/10/22
SECONDARY (If Used)				
IMW-537	Gauge, Pressure	0 to 15000 PSIG	150 PSIG	2011/10/22

TEST DATA				
MDMT (see drawing)		Test Commenced On (YYYY/MM/DD)		2011/01/18
-20				
PART DESCRIPTION	HEAT NUMBER	PART DESCRIPTION	HEAT NUMBER	HT# VERIFICATION
Shell	28535			All Heat Numbers Verified (Certs on File).
Head	K1445A			
Drain	MM0910082501			
				Checked By: kgrist
Metal Temp (> MDMT +30 F)		WATER TEMP >70F (ASME SECT I)		
Test Commenced By	Mlavigne	Witnessed By	N/A	
Employee #	523	Employee #	N/A	
Test Steps	Target (PSIG)	Actual Readings (PSIG)		Time
		Primary Gauge	Secondary Gauge	
(1) Pressure On	7,150	7200	7150	3:50 PM
(2) Pressure Off	7,200	7200	7250	4:25 PM
Test Completed By	Mlavigne	Witnessed By	N/A	
Employee #	523	Employee #	N/A	

AI Acceptance (when req'd):

Date:

NOTES	
Welded by Kyle T	

RESULTS	
Pressure gauge(s) used were calibrated and traceable to National and/or International Standards.	
IMW hereby certifies the UUT stated above was tested with the following results:	
<ul style="list-style-type: none"> ✓ Valid Pressure Gauge(s) Used ✓ Heat Numbers Verified ✓ Test Pressure Attained ✓ Test Pressure Maintained ✓ Test Duration Attained ✓ Hydrostatic (water) Test Type Confirmed 	
<h1>PASS</h1>	
Report Completed By: kgrist Report Date: 2011/01/18	



IMW PRESSURE TEST REPORT

Test Standard

CSA B51

UNIT UNDER TEST (UUT) DATA		TEST REQUIREMENTS	
Work Order ID	52300	Type (media)	Hydrostatic (water)
Part ID	205105	Design Pressure (PSIG)	5500
Part Description	Pulsation Bottle	Test Pressure (PSIG)	7150
Sequence ID	20	(Approx. 492.98 BAR, 49297.53 kPa)	
Serial #	52300-2	Duration (minutes)	30
Drawing ID (incl Rev.)	205105 Rev C		

PRESSURE GAUGE(S) USED				
Serial #	Description	Range	Accuracy +/-	Cal. Due
PRIMARY				
IMW-536	Gauge, Pressure	0 to 15000 PSIG	150 PSIG	2011/10/22
SECONDARY (If Used)				
IMW-537	Gauge, Pressure	0 to 15000 PSIG	150 PSIG	2011/10/22

TEST DATA				
MDMT (see drawing)		Test Commenced On (YYYY/MM/DD)		2011/01/18
-20				
PART DESCRIPTION	HEAT NUMBER	PART DESCRIPTION	HEAT NUMBER	HT# VERIFICATION
Shell	28535			All Heat Numbers Verified (Certs on File).
Head	K1445A			
Drain	MM0910082501			
				Checked By: kgrist
Metal Temp (> MDMT +30 F)		WATER TEMP >70F (ASME SECT I)		
Test Commenced By	Mlavigne	Witnessed By	N/A	
Employee #	523	Employee #	N/A	
Test Steps	Target (PSIG)	Actual Readings (PSIG)		Time
		Primary Gauge	Secondary Gauge	
(1) Pressure On	7,150	7200	7150	3:50 PM
(2) Pressure Off	7,200	7200	7250	4:25 PM
Test Completed By	Mlavigne	Witnessed By	N/A	
Employee #	523	Employee #	N/A	

AI Acceptance (when req'd):

Date:

NOTES	
Welded by Kyle T	

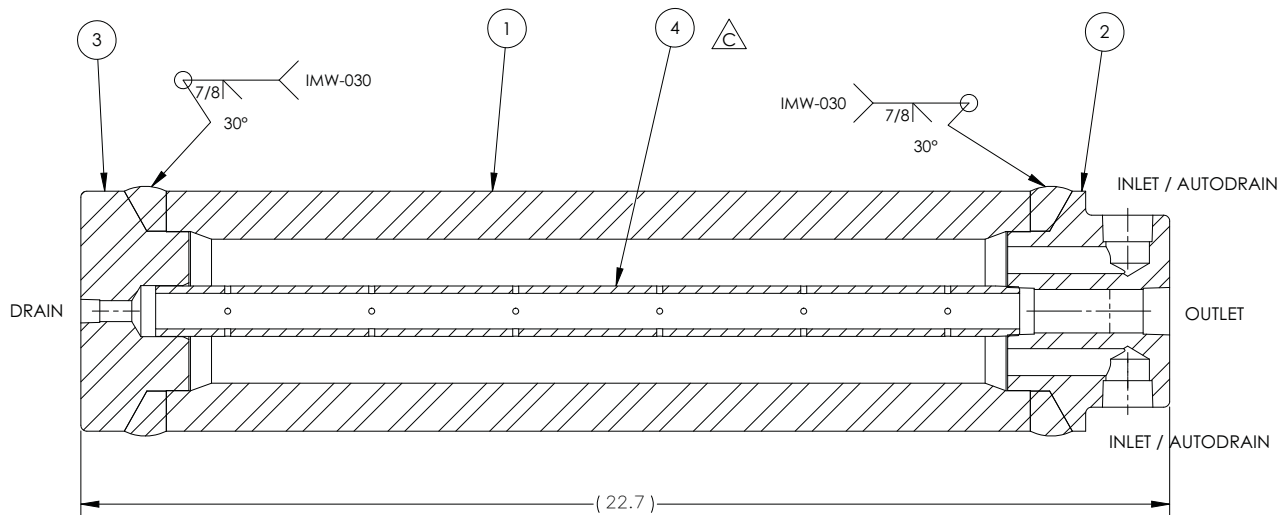
RESULTS	
Pressure gauge(s) used were calibrated and traceable to National and/or International Standards.	
IMW hereby certifies the UUT stated above was tested with the following results:	
<ul style="list-style-type: none"> ✓ Valid Pressure Gauge(s) Used ✓ Heat Numbers Verified ✓ Test Pressure Attained ✓ Test Pressure Maintained ✓ Test Duration Attained ✓ Hydrostatic (water) Test Type Confirmed 	
<div style="display: flex; justify-content: space-between;"> <div> <h1>PASS</h1> </div> <div> Report Completed By: kgrist Report Date: 2011/01/18 </div> </div>	



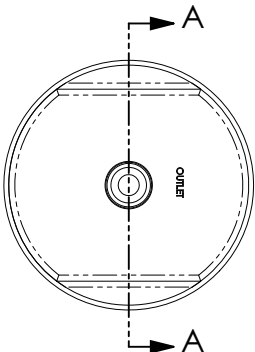
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DO NOT USE AS THE BASIS
FOR MANUFACTURE OR SALE OF
APPARATUS WITHOUT
PERMISSION.

REVISION HISTORY					
REV.	DATE	BY	CK.	DCR#	REFERENCE
A	2007/11/26	EDL	N/A		FIRST RELEASE
B	2008/02/21	EDL	N/A		UPDATED WELD SYMBOL TO SUIT NEW DESIGN
C	2008-07-22	DY	N/A	1222	CHANGED BOM ITEM 4 TO 18" WAS 18.25"



SECTION A-A





CERTIFIED BY
IMW INDUSTRIES LTD.
MAWP 5500 PSI AT 400°F
MAEWP 5500 PSI AT 400°F
MDMT -20°F AT 5500 PSI
MFG. SERIAL NO. _____
YEAR BUILT _____

CRN 0H5328.1, 0H09386.2 EXPIRES SEPT. 2018

DESIGN SPECIFICATIONS

MAWP:5500 PSIG @ 400°F
MDMT: -20°F @ 5500 PSIG
INTERNAL VOLUME: 105.8 CUBIC IN
USED FOR: SWEET DRY NATURAL GAS
PER NFPA 52
HIGHEST DEW POINT OF NATURAL GAS: -37°F
CORROSION ALLOWANCE: NONE
CAP / SHELL JOINT EFFICIENCY, E: 1.00
PWHT: NONE


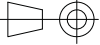
NDE REQUIREMENTS

HYDROSTATICALLY TEST AT 7150 PSIG
(1.3 TIMES DESIGN PRESSURE)

NO RADIOGRAPHIC EXAMINATION REQUIRED

APPLICABLE DESIGN CODES

CSA B51-03
BOILER, PRESSURE VESSEL AND PRESSURE PIPING CODE
ASME SECTION VIII, DIVISION 1
BOILER AND PRESSURE VESSEL CODE 2007, LATEST ADDENDA



IMW Industries Ltd.
Chilliwack, BC, Canada

TITLE

PULSATION BOTTLE 5500 PSIG

REF. I STANDARD	SIZE	FILE. NO.	REV
DR. I EDL 2007/11/27	C	205105	C
CK. I		DWG. NO. 205105	
AP. I	SCALE 1:2	WEIGHT 92	SHEET 1 / 1

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION	SIZE	UOM	SPECIFICATION	WEIGHT
1	1	205102	PULSATION BOTTLE SHELL	5 OD X 3 ID X 18 LG	EA	CS SA-106 GR.B	64
2	1	205103	PULSATION BOTTLE HEAD .75NPT	5 OD X 3.375	EA	CS SA-105	12.9
3	1	205104	PULSATION BOTTLE DRAIN .25NPT	5 OD X 2.25 LG	EA	CS SA-105	8.7
4	1	203363-00	BAFFLE 5 IN PULSATION DAMPER	n/a	EA	n/a	2.2



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Steel Certificate of Test

1835 DUEBER AVE. S.W.
CANTON, OHIO 44706
ID #0245906-1

Page 1 of 2

TIMKEN

Where You Turn

05/20/2010

S Marmon/Keystone Canada Inc.
O T 1220 HERITAGE ROAD
L O
D BURLINGTON ON L7L 4X9 Canada

S Marmon/Keystone Canada Inc
H T 400 Longwood Road South
I O
P Hamilton ON L8P 4Z3 Canada

Customer Order: HC1526-2 PAYABLE IN US FUNDS Customer Part Number: STEEL SERVICE CENTER
Timken Order: 56657-R (1642273) Heat Number(s): 90448

Description of Material

OD: 5.000 in (127.000 mm) WALL: 1.000 in (25.400 mm) ID: 3.000 in (76.200 mm)
Shape: RD
Sales Type: 1026
Int Quality: ULTRASONIC
Condition: HOT ROLL

Specification

- ASTM A 106 / A 106M Grades B and C Rev. 08 EXCEPT WEIGHING OF INDIVIDUAL TUBES & EXCEPT TOLERANCES
- ASTM E 213 Rev. 09 FOR NONDESTRUCTIVE ELECTRIC TESTING
- ASTM A 519 Rev. 06
- EUROPEAN STANDARD EN 10204 10/1/2004 Inspection certificate type 3.1
- ASME SA-106 Rev. 2004 EDITION GRADES B & C EXCEPT WEIGHING OF INDIVIDUAL TUBES & TOLERANCES
- NACE MR0175/ISO 15156 Rev. 2005

Chemistry Information

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%V
SPEC Ladle Min:	.22	.60			.10						
SPEC Ladle Max:	.28	.90	.030	.035		.40	.40	.15	.40		.080
90448 Ladle:	.27	.84	.012	.021	.25	.16	.16	.04	.18	.032	.002

When shipping document is attached it becomes part of this certification.

We certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications and consistent with our Standard Commercial Terms and Conditions for Sale, Manufacture, and Shipping, which are incorporated into and made part of this certification. The results of such inspections and tests conform with the applicable requirements including the purchase order, specification(s) and exception(s). This certificate or report shall not be reproduced except in full, without the written approval of the Timken Corporation.

Approved: _____

NOTARY PUBLIC

by

Cheryl Haas
Cheryl Haas, Metallographer

THE TIMKEN CORPORATION

Steel Certificate of Test

1835 DUEBER AVE. S.W.
CANTON, OHIO 44706

TIMKEN
Where You Turn

ID #0245906-1

Page 2 of 2

05/20/2010

Customer Order: HC1526-2 PAYABLE IN US FUNDS Customer Part Number: STEEL SERVICE CENTER
Timken Order: 56657-R (1642273) Heat Number(s): 90448

Metallurgy Information

SPEC: Flattening

Material is capable of meeting flattening requirements of ASTM A106 and ASME SA106.

SPEC: Hardness UOM ROCKWELL C HARDNESS 22 Max LOCATION MID

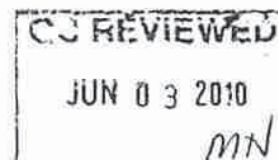
Heat	Piece#				UOM	
90448	MID	HARDNESS	187	/	187	ROCKWELL B
	MID	LOCATION	MID	/	MID	ROCKWELL B

SPEC: Tensile TENSILE 70,000.00 Min STRENGTH UOM PSI YIELD .2 40,000.00 Min
MIN ELONGATION 22 Min

Heat	Piece#	Tensile Strength	UOM	.2% Yld Strength	Elong %	%Red	Gauge Length	Specimen	Direction
90448	9E	86,780	PSI	72,173	23.2	57.7	2 IN	0.505 in RD	LONG.

Heat 90448 Melt Source: USA
Manufacturing: USA

Ultrasonic in lieu of hydrostatic testing - Satisfactory.
The Timken Company certifies that there is no mercury or radio-active material used in the melting or processing.
Material melted and produced in the USA



THE TIMKEN CORPORATION

ASCOMETAL

DOCUMENT DE CONTROLE

Inspection Documents / Prüfbescheinigungen

Inspection Certificate 3.1
NFEN 10204 / DIN EN 10204 : ISO R 404
2004 2004 2004



Livraison : 80146697 / 000007
N° Contrôle : 030000128331

Date : 10.05.2010
Date d'édition : 22.06.2010

HT F

ORDRE DE FABRICATION : G8133AF
WORKS ORDER NUMBER: WERKBESTELLUNG

COULEE : G8133
CAST / SCHMELZE

AFFAIRE SUIVIE PAR : LE CORRE
YOUR CONTACT IS: BEARBEITER

N/REFERENCE : 500966806 / 000010 (70035526)

ASCOMETAL ORDER: WERKBESTELLUNG

V/REFERENCE : SOC-13092 677945/75
YOUR ORDER INRS ZUSATZ 05.03.2010

QUANTITE : 5,210 TO
QUANTITY, MENGE

NUANCE : A105
GRAD: VERZINSSTOFF

PRODUIT : A105RON ECR 5,000 IN NOB
PRODUCT DESCRIPTION: BESCHREIBUNG

SPECIFICATION CLIENT : ASTM A105-A350LF2+A696GRC+API6A45K
SPECIFICATION: SPEZIFIKATION

IND : SANS DATE : 00.00.2001
REF: ENTWURF DATE/DATUM

CCU : 000003650

SPECIFICATIONS SUPP. : C2Q=430 S=35 P=35

enx-metals

Encore Metals

7470 Vantage Way
DELTA, B.C. V4G 1H1

Analyse chimique de coulée / Ladle analysis / Schmelzeanalyse

Elément (%)	Elément	Teil	C	Mn	Si	Cr	Ni	Mo	Co	P	S	Al
Mini	Spec min	Min		0,600	0,150							
Valeur	Actual	Werte	0,160	1,138	0,276	0,161	0,143	0,032	0,195	0,010	0,009	0,023
Maxi	Spec max	Max	0,230	1,350	0,300	0,300	0,400	0,120	0,400	0,035	0,035	
Elément	Elément	Teil	V	Cb								
Mini	Spec min	Min										
Valeur	Actual	Werte	0,048	0,0000								
Maxi	Spec max	Max	0,080	0,0200								
Contraintes groupées	Elément	Mini	Valeur	Maxi								
Ceq			0,420	0,430								

Caractéristiques mécaniques / Mechanical properties / Mechanische Kennwerte

Traction / tensile test / Zugversuch
Nappe / Batch number / Los number: G314
mid radius tested
Longitudinal test
Tensile test temperature (°F) 70

Elément	Elément	Teil	Ys.2%	UTS	E(2in)	RA
Unité	Unit	Meinheit	PSI	PSI	%	%
Mini	Spec min	Min	45000,0	70500,0	22,0	30,0
Valeur	Actual	Werte	5374,5	76212,0	32,1	59,2
Maxi	Spec max	Max		95000,0		

Résilience / Impact test / Kerschlagproben
Nappe / Batch number / Los number: G314
notch test: 10 x 10
Mid radius testing
Charpy V notch
Longitudinal test
Impact test temperature (°F) -50

Elément	Elément	Teil	Fv/Lbs	Fv/Lbs	Fv/Lbs	Exp lat	Exp lat	Exp lat
Unité	Unit	Meinheit	Fv/Lbs	Fv/Lbs	Fv/Lbs	Exp lat	Exp lat	Exp lat
Mini	Spec min	Min	11,0	11,0	11,0			
Valeur	Actual	Werte	86,4	73,0	75,3	0,0	0,0	0,1
Maxi	Spec max	Max						

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande, respectent la directive européenne 2000/13/CE du 18 septembre 2000 et présentent un niveau de radioactivité au plus égal à la radioactivité ambiante.

We hereby certify the above mentioned products are complying with the order requirements, are respectful of the September, 18th 2000 - 2000/13/CE - european directive, and have a radioactivity level which does not exceed that present in the environment.

Wir bestätigen damit dass die oben genannten Erzeugnisse den Bestäubungsverordnungen der EU-Richtlinie 2000/13/CE von 18 september 2000 entsprechen und das gefertigte Produkt keine Radioaktivität im höherem als natürliche Strahlung der Umwelt aufweist.

ASCOMETAL
SA à directoire et conseil de surveillance
au capital de 65 285 430 EUR
331 048 132 RCS Nanterre

Siège social : Immeuble le Colisée - 8, avenue de l'Arche, Faubourg de l'Arche, 92419 COURBEVOIE Cedex

ASCOMETAL

DOCUMENT DE CONTROLE

Inspection Documents / Prüfbescheinigungen



Département Métallurgie Qualité
Jang des Dunes - Boite postale 41
59941 Dunkerque Cedex 2
Téléphone : 03 28 29 60 00
Télécopie : 03 28 29 60 03

Inspection Certificate 3.3
NFEN 10204 / DIN EN 10204
2004 2004

ISO R 404
2004

Livraison : 80146697 / 000007
N° Contrôle : 030000128331

Date : 10.05.2010
Date d'édition : 22.06.2010

ORDRE DE FABRICATION : G8133AF
WORKS ORDER NUMBER / WERKBESTELLUNG

COULEE : G8133
CAST / SCHMELZE

AFFAIRE SUIVIE PAR : LE CORRE
YOUR CONTACT IS / BEARBEITER

N/REFERENCE : 500966806 / 000010 (70035526)
ASCOMETAL ORDER / WERKBESTELLUNG

V/REFERENCE : SOC-13092 677948/75
YOUR ORDER / IHRE ZEKHS

QUANTITE : 5,210 TO
QUANTITY / MENGE

NUANCE : A105
GRAD / WERKSTOFF

PRODUIT : A105 RON ECR 5000 IN NOR
PRODUCT DESCRIPTION / BESCHREIBUNG

SPECIFICATION CLIENT : ASTM A105-A350LF2+A696GRC+API6A45K
SPECIFICATION / SPEZIFIKATION

IND : SANS
REV / ENTWURF

DATE : 00.00.2001
DATE / DATUM

CCU : 0000003650

SPECIFICATIONS SUPP. : CEQ-430 S-35 P-35

Résilience / Impact test / Kerbschlagproben
Nappe / Batch number / Los nummer : G314
notch test 10 x 10
Mid radius testing
Charpy V notch
Longitudinal test
Impact test temperature (°F) : -60

Elément	Element	Teil	Fv/Lbs	Fv/Lbs	Fv/Lbs
Unité	Unit	Meinheit	Fv/Lbs	Fv/Lbs	Fv/Lbs
Mini	Spec min	Min			
Valeur	Actual	Werte	69,0	57,3	52,1
Maxi	Spec max	Max			

Résilience / Impact test / Kerbschlagproben
Nappe / Batch number / Los nummer : G314
notch test 10 x 10
Mid radius testing
Charpy V notch
Impact test temperature (°F) : -60
transverse test

Elément	Element	Teil	Fv/Lbs	Fv/Lbs	Fv/Lbs
Unité	Unit	Meinheit	Fv/Lbs	Fv/Lbs	Fv/Lbs
Mini	Spec min	Min			
Valeur	Actual	Werte	22,9	24,3	24,3
Maxi	Spec max	Max			

Traitement thermique / Heat treatment / Warmbehandlung

Traitement	T Min	T	T Max	Durée	Refroidissement
Norm. temp.		1652 °F		2,50 hrs	Normalized air cooled

Dureté de surface sur barres / Bars surface hardness / Stäbe Randhärte

Elément	Element	Teil	BHN top
Mini	Spec min	Min	
Valeur	Actual	Werte	170
Maxi	Spec max	Max	187

Autres résultats / Other results / Andere Prüfergebnisse

Elément	Mini	Valeur	Maxi
Grain size M-Quéid Ehn	5	7	8

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande, respectant la directive européenne 2000/53/CE du 18 septembre 2000 et présentant un niveau de radioactivité au plus égal à la radioactivité ambiante.

We hereby certify the above mentioned products are complying with the order requirements, are respectful of the September, 18th 2000 - 2000/53/CE - European directive, and have a radioactivity level which does not exceed that present in the environment.

Wir bestätigen hiermit dass die oben genannten Erzeugnisse den Bestellevorgaben, der EU-Richtlinie 2000/53/CE vom 18 September 2000 entsprechen und die darin festgesetzte Radioaktivität nicht überschreiten.

ASCOMETAL
SA à directeur et conseil de surveillance
au capital de 65 285 430 EUR
331 048 132 RCS Nanterre

Siège social : Immeuble le Colisée - 8, avenue de l'Arche, Faubourg de l'Arche, 92419 COURBEVOIS Cedex

ASCOMETAL

DOCUMENT DE CONTROLE

Inspection Documents / Prüfbescheinigungen

Inspection Certificate 3.1

NFEN 10204 / DIN EN 10204 / ISO R 404
2004 2004 2004

Livraison : 80146697 / 000007
N° Contrôle : 030000128331

Date : 10.05.2010
Date d'édition : 22.06.2010



Département Métallurgie Qualité
Usine des Dunes - Boite postale 41
59741 Desbœuf Cedex 2
Téléphone : 03 28 29 60 00
Téléfax : 03 28 29 60 03

ORDRE DE FABRICATION : G8133AF
WORKS ORDER NUMBER / WERKBESTELLUNG

COULÉE G8133
CAST / SCHMETZ

AFFAIRE SUIVIE PAR : LE CORRE
TOUR CONTACT IS - BEARBEITER

N/REFERENCE : 500966806 / 000010 (70035526)
ASCOMETAL ORDER WERKBESTELLUNG

V/REFERENCE : SOC-13092 677945/75
YOUR ORDER / IHRE BESTELLE

QUANTITE : 5,210 TO NUANCE : A105
QUANTITY / MENGE GRAD / WERKSTOFF

PRODUIT : A105IRON ECR / 5.000 INNOR
PRODUCT DESCRIPTION / BESCHREIBUNG

SPECIFICATION CLIENT : ASTM A105/A350LF2+A696GRC+API6A4SK
SPECIFICATION / SPEZIFIKATION

IND : SANS DATE : 00.00.2001
REV ENTWERF DATE / DATUM

CCU : 000003650

SPECIFICATIONS SUPP. : CEQ 430 S 35 P 35

en-c-metals
Encore Metals
7470 Vantage Way
DELTA, B.C. V4G 1H1

Electric furnace - vacuum degassed
Ultrasonic testing satisfactory per ASTM A388-05

Conforms to API 6A type 75K - PSL1-3
Conforms to NACE MR 01-75
Conforms to ASME SA105/SA350LF2
Conforms to ASTM A696 gr C - ASME SA696 gr C
No welding performed

LIN
Produit en France / Product of France / In Frankreich hergestellt

Visa du chef de service
Stamp of inspection supervisor
Der Werksachverständige
Anne Fasquelle

A Fasquelle

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la norme, respectant la directive européenne 2000/53/CE du 18 septembre 2000 et présentant un niveau de radioactivité au plus égal à la radioactivité ambiante.

ASCOMETAL
SA à directoire et conseil de surveillance
au capital de 65 285 430 EUR
331 048 132 RCS Nanterre

We hereby certify the above mentioned products are complying with the order requirements, are respectful of the September 18th 2000 - 2000/53/CE - European directive, and have a radioactivity level which does not exceed that present in the environment.

Siège social : Immeuble le Colisée - 8, avenue de l'Arche, Faubourg de l'Arche, 92419 COURBEVOIE Cedex

Wir bestätigen hiermit dass die oben genannten Erzeugnisse den Bestimmungen entsprechen, der EU-Richtlinie 2000/53/CE vom 18 September 2000 entsprechen und die gefertigten Produkte keine Radioaktivität, die höher ist als natürliche Strahlung der Umwelt aufweisen.



Département Métallurgie Qualité
Usine des Dunes - Boite postale 41
59941 Dunkerque Cedex 2
Téléphone : 03 28 29 60 03
Télécopie : 03 28 29 60 03

DOCUMENT DE CONTROLE

Inspection Documents / Prüfbescheinigungen

Inspection Certificate 3.1

NFEN 10204 : DIN EN 10204 : ISO R 404
2004 2004 2004

Livraison : 80145980 / 000001
N° Contrôle : 030000123337

Date : 22.04.2010
Date d'édition : 11.06.2010

Heat

ORDRE DE FABRICATION : G7491AD
WORKS ORDER NUMBER / WERKBESTELLUNG

COULEE : G7491
CAST / SCHMELZE

DESTINATAIRE DOCUMENT :
DOCUMENT FOR EMPFANGER

AFFAIRE SUIVIE PAR : LE CORRE
YOUR CONTACT IS : BEARBEITER

N/REFERENCE : 500954702 / 000010 (70033345)

ASCOMETAL ORDER / WERKBESTELLUNG

V/REFERENCE : SOC-13071 180B674283 (0112-7750)
YOUR ORDER / IHRE ZEICHE : 29.12.2009

QUANTITE : 4,255 TO NUANCE : A105
QUANTITY / MENGE : GRAD / WERKSTOFF

PRODUIT : A105 RON ECR : 5,250 IN NOR
PRODUCT DESCRIPTION / BESCHREIBUNG

SPECIFICATION CLIENT : ASTM A105-A350LF2+A696GRC+API6A45K
SPECIFICATION / SPEZIFIKATION

IND : SANS DATE : 00.00.2001
REV / ENTWURF / DATE / DATUM

CCU : D000003650

SPECIFICATIONS SUPP. : CEQ<=430 S<=35 P<=35

Analyse chimique de coulée / Ladie analysis / Schmelzeanalyse

Elément (%)	Element	Teil	C	Mn	Si	Cr	Ni	Mo	Cu	P	S	Al
Mini	Spec min	Min		0,600	0,150							
Valeur	Actual	Werte	0,181	1,209	0,208	0,143	0,105	0,037	0,170	0,012	0,016	0,026
Maxi	Spec max	Max	0,230	1,350	0,300	0,300	0,400	0,120	0,400	0,035	0,035	
Elément	Element	Teil	V	Cb								
Mini	Spec min	Min										
Valeur	Actual	Werte	0,006	0,0000								
Maxi	Spec max	Max	0,080	0,0200								

Contraintes groupées

Elément	Mini	Valeur	Maxi
CEQ		0,438	0,430

Caractéristiques mécaniques / Mechanical properties / Mechanische Kennwerte

Traction / tensile test / Zugversuch

Nappe / Batch number / Loss number : U004

Mid radius tested

Longitudinal test

Tensile test temperature (°F) : 70

Elément	Element	Teil	Ys.2%	UTS	E (2in)	RA
Unité	Unit	Meinheit	PSI	PSI	%	%
Mini	Spec min	Min	45000,0	70500,0	22,0	30,0
Valeur	Actual	Werte	50619,5	76081,5	32,8	59,8
Maxi	Spec max	Max		95000,0		

Résilience / Impact test / Kerbschlagproben

Nappe / Batch number / Los nummer : U004

Notch test 10 x 10

Mid radius testing

Charpy V notch

Longitudinal test

Impact test temperature (°F) : -50

Elément	Element	Teil	Ft/Lbs	Ft/Lbs	Ft/Lbs	Exp lat	Exp lat	Exp lat
Unité	Unit	Meinheit	Ft/Lbs	Ft/Lbs	Ft/Lbs	"	"	"
Mini	Spec min	Min	11,0	11,0	11,0			
Valeur	Actual	Werte	84,4	92,0	84,5	0,0	0,0	0,0
Maxi	Spec max	Max						

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande, respectent la directive européenne 2010/53/CE du 18 septembre 2000 et présentent un niveau de radioactivité au plus égal à la radioactivité ambiante.

We hereby certify the above mentioned products are complying with the order requirements, are respectful of the September, 18th 2000 - 2000/53/CE - European directive, and have a radioactivity level which does not exceed that present in the environment.

Wir bestätigen hiermit dass die obengenannten Erzeugnisse den Bestimmungsvorschriften, der EU-Richtlinie 2000/53/CE von 18 September 2000 entsprechen und die gelieferten Produkte keine Radioaktivität, die Höher ist als natürliche Strahlung der Umwelt, aufweisen.

ASCOMETAL

SA à directoire et conseil de surveillance
au capital de 65 285 430 EUR
331 048 132 RCS Nanterre

Siège social : Immeuble le Colisée - 8, avenue de l'arche, Faubourg de l'Arche, 92419 COURBEVOIE Cedex

4121750/93232125
93232125

Tin = 4202

DOCUMENT DE CONTROLE

Inspection Documents / Prüfbescheinigungen

Inspection Certificate 3.1

NFEN 10204 : 2004
 DIN EN 10204 : 2004
 ISO R-04 : 2004

Livraison : 80145980 / 000001
 N° Contrôle : 030000123337

Date : 22.04.2010
 Date d'édition : 11.06.2010

Heat

ORDRE DE FABRICATION : G7491AD WORKS ORDER NUMBER - WERKBESTELLUNG		COULEE G7491 CAST - SCHMELZE		DESTINATAIRE DOCUMENT : DOCUMENT FOR EMPFANGER	
AFFAIRE SUIVIE PAR : LE CORRE YOUR CONTACT IS - BEARBEITER				Société RYERSON 7945, CORONET ROAD EDMONTON ALB T6E 4N7 Canada	
N/REFERENCE : 500954702 / 000010 (70033345) ASCOMETAL ORDER - WERKBESTELLUNG				MARQUE :	
V/REFERENCE : SOC-13071 180B674283 (0112-7750) YOUR ORDER - IHRE ZEICHE					
QUANTITE : 4,255 TO QUANTITY - MENGE		NUANCE : A105 GRAD - WERKSTOFF			
PRODUIT : A105 RON ECR PRODUCT DESCRIPTION - BESCHREIBUNG		5,250 IN NOR			
SPECIFICATION CLIENT : ASTM A105+A350LF2+A696GRC+API6A45K SPECIFICATION - SPEZIFIKATION					
END : SANS REV - ENTWURF		DATE : 00.00.2001 DATE - DATUM		CCU : D000003650	
SPECIFICATIONS SUPP. : CEQ<=430 S<=35 P<=35					

Résilience / Impact test / Kerbschlagproben Nappe / Batch number / Los nummer : U004 notch test 10 x 10 Mid radius testing Charpy V notch Longitudinal test Impact test temperature (°F) : -60					
Elément	Element	Teil	Ft/Lbs	Ft/Lbs	Ft/Lbs
Unité	Unit	Meinheit	Ft/Lbs	Ft/Lbs	Ft/Lbs
Mini	Spec min	Min			
Valeur	Actual	Werte	77,6	89,2	96,6
Maxi	Spec max	Max			

Résilience / Impact test / Kerbschlagproben Nappe / Batch number / Los nummer : U004 notch test 10 x 10 Mid radius testing Charpy V notch Impact test temperature (°F) : -60 transverse test					
Elément	Element	Teil	Ft/Lbs	Ft/Lbs	Ft/Lbs
Unité	Unit	Meinheit	Ft/Lbs	Ft/Lbs	Ft/Lbs
Mini	Spec min	Min			
Valeur	Actual	Werte	15,0	17,7	16,4
Maxi	Spec max	Max			

Traitement thermique / Heat treatment / Warmbehandlung					
Traitement	T Min	T	T Max	Durée	Refroidissement
Norm. temp.		1652 °F		2,75 hrs	Normalized air cooled

Dureté de surface / Surface hardness / Randhärte					
Elément	Element	Teil	BHN top		
Mini	Spec min	Min			
Valeur	Actual	Werte	170		
Maxi	Spec max	Max	187		

Autres résultats / Other results / Andere Prüfergebnisse			
Elément	Mini	Valeur	Maxi
Grain size M-Quaid Ehn	5	7	8

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande, respectent la directive européenne 2000/53/CE de 18 septembre 2000 et présentent un niveau de radioactivité au plus égal à la radioactivité ambiante.

We hereby certify the above mentioned products are complying with the order requirements, are respectful of the September, 18th 2000 - 2000/53/CE - european directive, and have a radioactivity level which does not exceed that present in the environment.

Wir bestätigen hiermit dass die obengenannten Erzeugnisse den Bestimmungsvorschriften, der EU-Richtlinie 2000/53/CE vom 18 september 2000 entsprechen und die gelieferten Produkte keine Radioaktivität, die Höher ist als natürliche Strahlung der Umwelt, aufweisen.

ASCOMETAL
 SA à directoire et conseil de surveillance
 au capital de 65 285 430 EUR
 33 1 048 132 RCS Nanterre

Siège social : Immeuble le Colisée - 8, avenue de l'arche, Faubourg de l'Arche, 92419 COURBEVOIE Cedex

DOCUMENT DE CONTROLE

Inspection Documents / Prüfbescheinigungen

Inspection Certificate 3.1

NFEN 10204 DIN EN 10204 ISO R 404
2004 2004 2004

Livraison : 80145980 / 000001
N° Contrôle : 030000123337

Date : 22.04.2010
Date d'édition : 11.06.2010

Heat

ORDRE DE FABRICATION : G7491AD WORKS ORDER NUMBER - WERKBESTELLUNG		COULEE : G7491 CAST - SCHMELZE	DESTINATAIRE DOCUMENT : DOCUMENT FOR EMPFANGER
AFFAIRE SUIVIE PAR : LE CORRE YOUR CONTACT IS - BEARBEITER		Société RYERSON	
N/REFERENCE : 500954702 / 000010 (70033345) ASCOMETAL ORDER - WERKBESTELLUNG		7945, CORONET ROAD EDMONTON ALB T6E 4N7 Canada	
V/REFERENCE : SOC-13071 180B674283 (0112-7750) YOUR ORDER - IHRE ZEICHE		MARQUE :	
QUANTITE : 4,255 TO QUANTITY - MENGE		NUANCE : A105 GRAD - WERKSTOFF	
PRODUIT : A105 RON ECR 5,250 IN NOR PRODUCT DESCRIPTION - BESCHREIBUNG			
SPECIFICATION CLIENT : ASTM A105+A350LF2+A696GRC+API6A45K SPECIFICATION - SPEZIFIKATION			
IND : SANS REV - ENTWURF		DATE : 00.00.2001 DATE - DATUM	CCU : D000003650
SPECIFICATIONS SUPP. : CEQ<=430 S<=35 P<=35			
Electric furnace - vacuum degassed Ultrasonic testing satisfactory per ASTM A388-05			
Conforms to API 6A type 75K - PSL1-3 Conforms to NACE MR 01-75 Conforms to ASME SA105/SA350LF2 Conforms to ASTM A696 gr C - ASME SA696 gr C No welding performed			
LIN Produit en France / Product of France / In Frankreich hergestellt U004			

Visa du chef de service
Stamp of inspection supervisor
Der Werkssachverständige
Anne Fasquelle

A Fasquelle

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande, respectent la directive européenne 2000/53/CE du 18 septembre 2000 et présentent un niveau de radioactivité au plus égal à la radioactivité ambiante.

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ASCOMETAL
SA à directoire et conseil de surveillance
au capital de 65 285 430 EUR
331 048 132 RCS Nanterre

Siège social : Immeuble le Colisée - 8, avenue de l'arche, Faubourg de l'Arche, 92419 COURBEVOIE Cedex

Steel Certificate of Test

1835 DUEBER AVE. S.W.
CANTON, OHIO 44706
ID #0253594-1

Page 1 of 2

TIMKEN
Where You Turn
08/17/2010

2 bars

Customer Order: 87-11571-006 Customer Part Number: 5.1-130
Timken Order: 33911-R (1674495) Heat Number(s): 28535, 28536

Description of Material

OD: 5.000 in (127.000 mm) WALL: 1.000 in (25.400 mm) ID: 3.000 in (76.200 mm)
Shape: RD
Sales Type: 1020
Int Quality: ELECTRIC FURNACE-ULTRASONIC
Condition: HOT ROLL

Specification

- ASTM A 106 / A 106M Grades B and C Rev. 08 EXCEPT TOLERANCES & WEIGHING OF INDIVIDUAL TUBES
- ASME SA-106 Rev. 2004 EDITION GRADES B & C EXCEPT WEIGHING OF INDIVIDUAL TUBES & EXCEPT TOLERANCES
- ASTM E 213 Rev. 09 FOR NONDESTRUCTIVE ELECTRIC TESTING
- ASTM A 519 Rev. 06
- NACE NACE MR0175/ISO 15156 Rev. 2005
- EUROPEAN STANDARD EN 10204 10/1/2004 Inspection certificate type 3.1

Chemistry Information

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%V
SPEC Ladle Min:	.22	.60			.10						
SPEC Ladle Max:	.28	.90	.025	.025		.40	.40	.15	.40		.080
28535 Ladle:	.27	.86	.010	.020	.25	.12	.09	.02	.22	.024	.002
28536 Ladle:	.26	.85	.011	.020	.25	.12	.07	.02	.17	.034	.002

When shipping document is attached it becomes part of this certification.

We certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications and consistent with our Standard Commercial Terms and Conditions for Sale, Manufacture, and Shipping, which are incorporated into and made part of this certification. The results of such inspections and tests conform with the applicable requirements including the purchase order, specification(s) and exception(s). This certificate or report shall not be reproduced except in full, without the written approval of the Timken Corporation.

Approved: _____

NOTARY PUBLIC

by

Sean P. Zaleski
Sean Zaleski, SR LABORATORY TECHNICIAN

THE TIMKEN CORPORATION

Steel Certificate of Test

1835 DUEBER AVE. S.W.
CANTON, OHIO 44706

TIMKEN
Where You Turn

ID #0253594-1

Page 2 of 2

08/17/2010

Customer Order: 87-11571-006 Customer Part Number: 5.1.130
Timken Order: 33911-R (1674495) Heat Number(s): 28535, 28536

Metallurgy Information

SPEC: Flattening

Material is capable of meeting flattening requirements of ASTM A106 and ASME SA106.

SPEC: Hardness UOM ROCKWELL C HARDNESS 22 Max LOCATION MID

Heat	Pieces	HARDNESS	UOM
28535	1	87 / 5	ROCKWELL C
	1	LOCATION MID / MID	ROCKWELL C

SPEC: Tensile TENSILE 70,000.00 Min STRENGTH UOM PSI YIELD .2 40,000.00 Min
MIN ELONGATION 22 Min

Heat	Pieces	Tensile Strength	UOM	.2% Yld Strength	Elong	%Red	Gauge Length	Specimen	Direction
28535	1	84,110	PSI	47,466	27.9	58.1	2 IN	0.505 in RD	LONG.
	2	80,600	PSI	45,929	29.7	59.8	2 IN	0.505" RD	LONG.

Heat 28535 Melt Source: USA
Heat 28536 Melt Source: USA
Manufacturing: USA

Ultrasonic in lieu of hydrostatic testing - Satisfactory.
The Timken Company certifies that there is no mercury or radio-active material used in the melting or processing.
"STRAND CAST PROCESS"
Material melted and produced in the USA

THE TIMKEN CORPORATION



Corus UK Ltd.
Corus Engineering Steels
PO Box 50,
Aldwarke Lane,
Rotherham, S60 1DW,
United Kingdom
Telephone: +44 (0)1709 371234
Fax (main): +44 (0)1709 826233
Website: www.corusgroup.com

INSPECTION CERTIFICATE/TYPE 3.1 to BS EN10204

CORUS AMERICA INC
475 NORTH MARTINGALE DRIVE
SUITE 400 SCHAUMBURG
ILLINOIS 60173 - 2222
USA

HT

Cast No. K1445A

Works Order No. CB817023

Customer Order No. P101070 (121091)

Date of Issue 22-JUL-2010

Certificate No. 00278388/1

Page No. 1 of 5

SPECIFICATIONS ASSOCIATED WITH THIS ORDER -
LF2 TO ASTM A350 + (7) ADDITIONAL SPECS K1445A
NACE MR0175 2003 CARBON
ASTM A696; 90A(R2006) GRADE C
ASME SA-696 REV.04 GRADE C
ASTM A105;/A105M REV.09
ASME SA105;/SA105M REV.A06
ASTM A350;/A350M REV.07 LF2
ASME SA-350;SA-350M REV.A06 LF2
API 6A EDN.19-Er3 36K CLASS L PSL3

PRODUCT INFORMATION -

SIZE - 6.25"

QUANTITY/WEIGHT - As per invoice

CONDITION OF MATERIAL - COLD STR, NORMALISED, SM TURN

STEELMAKING PROCESS/PROCESS OF MANUFACTURE - Electric VDG Ingot

HEAT TREATMENT OF MATERIAL -

Normalise at 880°C; for 02:00; Air Cooled.

ANALYSIS -

Cast No	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	Sn	Nb	V
Cast Analysis												
K1445A	.165	.20	1.27	.012	.011	.12	.03	.09	.12	.014	< .001	< .001



Corus UK Ltd,
Corus Engineering Steels
PO Box 50,
Aldwarke Lane,
Rotherham, S60 1DW,
United Kingdom.
Telephone: +44 (0)1709 371234
Fax (main): +44 (0)1709 826233
Website: www.corusgroup.com

INSPECTION CERTIFICATE/TYPE 3.1 to BS EN10204

Cast No. **K1445A**

Works Order No. CB817023

Customer Order No. P101070 (121091)

Date of Issue 22-JUL-2010

Certificate No. 00278388/1

Page No. 2 of 5

Mechanical Test - Tested to ASTM A370 09a(E1) / ASTM E8 08

Material Specification ASTM **A105**

	Test No.	Ingot Id	Ingot Pos.	Sample Pos.	Orient	Temp.	0.2% PS	U.T.S	Elong	R of A	Hardness	Hardness
Units						C	PSI	PSI	%	%	HBW10/3000	HBW10/3000
Result	1449257	37	M	Mid-Radial	Lo	23	40200 /	74500 /	37.0 /	70.7	163	163

Mechanical Test - Tested to ASTM A370 09a(E1)

Material Specification ASTM A350-97

	Test No.	Ingot Id	Ingot Pos.	Sample Pos.	Orient	Temp.	0.2% PS	U.T.S	Elong	R of A
Units						C	kPSI	kPSI	%	%
Result	1449258	37	M	Mid-Radial	Lo	23	40.2	74.6	37.0	70.7

Impact Test - Tested to ASTM E23 07a(E1)

Material Specification ASTM A350-97

	Test No.	Ingot Id	Ingot Pos.	Sample Pos.	Geometry	Orient	Temp.	Imp Mean	Impact	Impact	Impact
Units							F	FTlbs	FTlbs	FTlbs	FTlbs
Result	1449259	37	M	Mid-Radial	CH2MMV	Lo	-50	55	32	99	34

Mechanical Test - Tested to ASTM A370 09a(E1)

ASTM A696 90A(REAPPROVED 1995)E1

	Test No.	Ingot Id	Ingot Pos.	Sample Pos.	Orient	Temp.	0.2% PS	U.T.S	Elong	R of A
Units						C	PSI	PSI	%	%
Result	1449257	37	M	Mid-Radial	Lo	23	40200	74500	37.0	70.7

HOT ROLLED RO. 5.0000 X 20" R/L
PART NO.

PO/Rel B100882

I hereby certify that this data is correct as
contained in the records of this company.
I hereby certify that no mercury came in contact

Certificate of Mill Test Resu.

SO 1 -204096-001 250c,
Pg 1/1

with or no weld repair was done to this product
while in our possession.
Attn:

Mill Certification 8/14/2009

PO # 19658

200945	100810.7
Special Bar Quality	30005000240ASA8
ASTM A105/A350	MM09100825
5" Round	MM0910082501 HT#
5" Round 20' A105AL Nucor A105 BK	G1-201788
A105AL Nucor A105	G1-100437
	KREHER PO 19658

I hereby certify that the material described herein has been manufactured in accordance with the specifications and standards listed above and that it satisfies those requirements.

4 bars minimum per bundle/2 tags per bundle
Call for appt 24 hr in advance 708-345-8180 x160
tags include size, grade, shape, length, m bundle wt, & heat
bundles to be separated by 4 x4 blocking both horizontal & vr
Trucks must be tarped.
Packing slips for rail fax to 708-345-9986

C	Mn	P	S	Si	Cr	Mo	Cu	Al	V	Ni	Cb
0.18%	1.04%	0.008%	0.005%	0.18%	0.11%	0.02%	0.16%	0.029%	0.005%	0.05%	0.001%
Ti	N	Sn	B	H							
0.001%	0.0075%	0.003%	0.0002%	1.0 ppm							

Yield 1: 41800 (288) Psi (MPa)

Reduction of Area: 53.8 %

Reduction Ratio: 7.3 :1

ASTM E381

Center: 2 Mid Radius: 2 Surface: 1

Tensile 1: 74700 (515) Psi (MPa)

Grain Size per ASTM E112 = 7

Elongation: 29.8 % in 2" (% in 50.8mm)

Brinell: 150,000

Specification Comments: CERTIFIED TO EN 10204 3.1

1. All manufacturing processes, including melting have been performed in the U.S.A.
2. Mercury, in any form, has not been used in the production or testing of this material.
3. Welding or weld repair was not performed on this material.
4. This material conforms to the specifications described on this document and may not be reproduced except in full, without written approval of Nucor Corporation.
5. This product is NAFTA certified under Paragraph "B" of the NAFTA rule of origin.

Todd K. Smiley

Todd Eviszior
Division Metallurgist

Page 1 of 1

NSM040 May 12, 2009



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MERCER VALVE CO., INC.®

Sales
(800) 833-6402
(405) 495-6533
(405) 495-6536

AUTO SEAT TECHNOLOGY®
Post Office Box 270970
Oklahoma City, Oklahoma 73137
Fax (405) 495-8728

Purchasing
(405) 789-2994
(405) 789-0664

Accounting
(405) 495-7178

24 HOUR SERVICE AVAILABLE
www.mercervalve.net

Engineering
(405) 495-3274

CERTIFICATE OF COMPLIANCE

Customer Name: IMW INDUSTRIES LTD
43676 PROGRESS WAY CHILLIWACK BC V2R 0C3 CANADA

Customer PO Number: 76521

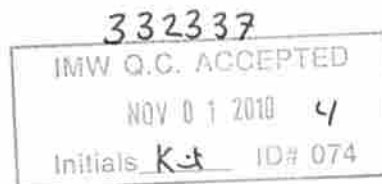
Item Description: Qty: (4) 91-12D61P15E1
Series 9100
Set @ 2450 psi
Capacity SCFM Air 4957
Repair Kit Number:

¾" MALE X 1" FEMALE
Serial Number(s) 617046 - 617049
Customer PN
1D1P1E2

Mercer Valve Sales Order Number: 1C455
Mercer Valve Job Order Number: 1C455-5

Valve Setting Instructions:

Set Pressure: 2450 psi
Set Pressure Tolerance: 3%
Test Medium: Air



This certifies that the valves purchased on the above sales order number were built per section VIII, Division 1 of ASME boiler and pressure vessel code as indicated by the UV on the nameplate.

Certified Individual
Quality Control



MERCER VALVE CO., INC.®

Sales
(800) 833-6402
(405) 495-6533
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AUTO SEAT TECHNOLOGY®
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(405) 789-0664

Accounting
(405) 495-7178

24 HOUR SERVICE AVAILABLE
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Engineering
(405) 495-3274

CERTIFICATE OF COMPLIANCE

Customer Name: IMW INDUSTRIES LTD
43676 PROGRESS WAY CHILLIWACK BC V2R 0C3 CANADA

Customer PO Number: 77943

Item Description: Qty: (4) 81-12151T43G11
Series 8100
Set @ 1000 psi
Capacity SCFM Air 3456
Repair Kit Number:

¾" MALE X 1" FEMALE
Serial Number(s) 653772 - 653775
Customer PN
11T1G12

Mercer Valve Sales Order Number: 1D897
Mercer Valve Job Order Number: 1D897-4

Valve Setting Instructions:

Set Pressure: 1000 psi
Set Pressure Tolerance: 3%
Test Medium: Air

P/N 332533 POT7943

IMW Q.C. ACCEPTED

JAN 05 2011

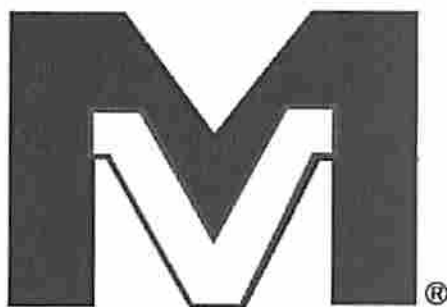
Initials *CMU* ID# *601*

This certifies that the valves purchased on the above sales order number were built per section VIII, Division 1 of ASME boiler and pressure vessel code as indicated by the UV on the nameplate.

Certified Individual
Quality Control

Office Number
1-800-833-6402

Webpage
www.mercervalue.net



Fax Number
405-495-8728

Email
sales@mercervalue.net

MERCER VALVE CO., INC.®
AUTO SEAT TECHNOLOGY®

CERTIFICATE OF COMPLIANCE

Customer Name: IMW INDUSTRIES LTD
43676 PROGRESS WAY CHILLIWACK BC V2R 0C3 CANADA

Customer PO Number: 79504 ✓

Item Description: Qty: (2) 81-12151T43G11 ✓
Series 8100
Set @ 800 psi ✓
Capacity SCFM Air 2774
Repair Kit Number:

¾" MALE X 1" FEMALE ✓
Serial Number(s) 664929 - 664930 ✓
Customer PN

11T1G12

PN 332840

Mercer Valve Sales Order Number: 1F156
Mercer Valve Job Order Number: 1F156-2

Valve Setting Instructions:

Set Pressure: 800 psi
Set Pressure Tolerance: 3%
Test Medium: Air

IMW Q.C. ACCEPTED

FEB 10 2011

Initials JL ID# 668

This certifies that the valves purchased on the above sales order number were built per section VIII, Division 1 of ASME boiler and pressure vessel code as indicated by the UV on the nameplate.

Certified Individual
Quality Control

Office Number
1-800-833-6402

Webpage
www.mercervalue.net



Fax Number
405-495-8728

Email
sales@mercervalue.net

MERCER VALVE CO., INC.®
AUTO SEAT TECHNOLOGY®

CERTIFICATE OF COMPLIANCE

Customer Name: IMW INDUSTRIES LTD
43676 PROGRESS WAY CHILLIWACK BC V2R 0C3 CANADA

Customer PO Number: 79031

Item Description: Qty: (14) 81-12151V36G11 ✓
Series 8100
Set @ 115 psi ✓
Capacity SCFM Air 438
Repair Kit Number:

3/4" MALE X 1" FEMALE ✓
Serial Number(s) 668245 - 668258 ✓
Customer PN
11V1G11 ✓

Mercer Valve Sales Order Number: 1E848
Mercer Valve Job Order Number: 1E848-1

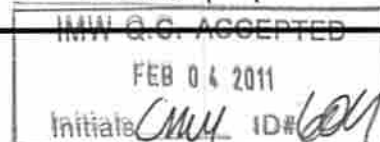
Valve Setting Instructions:

Set Pressure: 115 psi
Set Pressure Tolerance: 3%
Test Medium: Air

This certifies that the valves purchased on the above sales order number were built per section VIII, Division 1 of ASME boiler and pressure vessel code as indicated by the UV on the nameplate.

Certified Individual
Quality Control

PO 79031
PN 331877



Office Number
1-800-833-6402

Webpage
www.mercervalue.net



Fax Number
405-495-8728

Email
sales@mercervalue.net

MERCER VALVE CO., INC.®
AUTO SEAT TECHNOLOGY®

CERTIFICATE OF COMPLIANCE

Customer Name: IMW INDUSTRIES LTD
43676 PROGRESS WAY CHILLIWACK BC V2R 0C3 CANADA

Customer PO Number: 81508

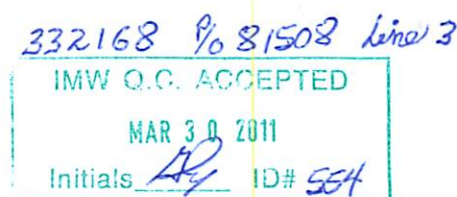
Item Description: Qty: (10) 91-M2C61P5641 ✓
Series 9100 Mod-20
Set @ 5000 psi ✓
Capacity SCFM Air 5127
Repair Kit Number:

3/4" MALE X 1" FEMALE ✓
Serial Number(s) 678118 - 678127 ✓
Customer PN
1C1P143

Mercer Valve Sales Order Number: 1H211
Mercer Valve Job Order Number: 1H211-1

Valve Setting Instructions:

Set Pressure: 5000 psi ✓
Set Pressure Tolerance: 3%
Test Medium: Air



This certifies that the valves purchased on the above sales order number were built per section VIII, Division 1 of ASME boiler and pressure vessel code as indicated by the UV on the nameplate.

Certified Individual
Quality Control



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IMW PRESSURE TEST REPORT

Test Standard

CSA B51

UNIT UNDER TEST (UUT) DATA		TEST REQUIREMENTS	
Work Order ID	50164	Type (media)	Hydrostatic (water)
Part ID	202579-00	Design Pressure (PSIG)	5500
Part Description	Coalescing Filter, CF-5500	Test Pressure (PSIG)	7150
Sequence ID	30	(Approx. 492.98 BAR, 49297.53 kPa)	
Serial #	50164-10 to 50164-19	Duration (minutes)	30
Drawing ID (incl Rev.)	202579-00 Rev F		

PRESSURE GAUGE(S) USED				
Serial #	Description	Range	Accuracy +/-	Cal. Due
PRIMARY				
IMW-536	Gauge, Pressure	0 to 15000 PSIG	150 PSIG	2011/10/22
SECONDARY (If Used)				
IMW-537	Gauge, Pressure	0 to 15000 PSIG	150 PSIG	2011/10/22

TEST DATA				
MDMT (see drawing)		Test Commenced On (YYYY/MM/DD)		2011/02/14
-20				
PART DESCRIPTION	HEAT NUMBER	PART DESCRIPTION	HEAT NUMBER	HT# VERIFICATION
Head	MM0910082602			All Heat Numbers Verified (Certs on File). Checked By: kgrist
Bowl	K1445A			
Metal Temp (> MDMT +30 F)		WATER TEMP >70F (ASME SECT I)		
Test Commenced By	kgrist	Witnessed By		N/A
Employee #	128	Employee #		N/A
Test Steps	Target (PSIG)	Actual Readings (PSIG)		Time
		Primary Gauge	Secondary Gauge	
(1) Pressure On	7,150	7225	7175	2:05 PM
(2) Pressure Off	7,225	7225	7175	2:40 PM
Test Completed By	kgrist	Witnessed By		N/A
Employee #	128	Employee #		N/A
AI Acceptance (when req'd):		Date:		

NOTES

RESULTS
Pressure gauge(s) used were calibrated and traceable to National and/or International Standards. IMW hereby certifies the UUT stated above was tested with the following results: <ul style="list-style-type: none">✓ Valid Pressure Gauge(s) Used✓ Heat Numbers Verified✓ Test Pressure Attained✓ Test Pressure Maintained✓ Test Duration Attained✓ Hydrostatic (water) Test Type Confirmed
PASS
Report Completed By: kgrist Report Date: 2011/02/14



IMW PRESSURE TEST REPORT

Test Standard

CSA B51

UNIT UNDER TEST (UUT) DATA		TEST REQUIREMENTS	
Work Order ID	55046	Type (media)	Hydrostatic (water)
Part ID	202579-00	Design Pressure (PSIG)	5500
Part Description	Coalescing Filter	Test Pressure (PSIG)	7150
Sequence ID	30	(Approx. 492.98 BAR, 49297.53 kPa)	
Serial #	55046-5 to 55046-10	Duration (minutes)	30
Drawing ID (incl Rev.)	202579-00 Rev F		

PRESSURE GAUGE(S) USED				
Serial #	Description	Range	Accuracy +/-	Cal. Due
PRIMARY				
IMW-536	Gauge, Pressure	0 to 15000 PSIG	150 PSIG	2011/10/22
SECONDARY (If Used)				
IMW-537	Gauge, Pressure	0 to 15000 PSIG	150 PSIG	2011/10/22

TEST DATA				
MDMT (see drawing)		Test Commenced On (YYYY/MM/DD)		2011/03/04
-20				
PART DESCRIPTION	HEAT NUMBER	PART DESCRIPTION	HEAT NUMBER	HT# VERIFICATION
Head	MM0910082501			All Heat Numbers Verified (Certs on File). Checked By: kgrist
Bowl	K1445A			
Metal Temp (> MDMT +30 F)		WATER TEMP >70F (ASME SECT I)		
Test Commenced By	Jhadley	Witnessed By		Ken Grist
Employee #	685	Employee #		128
Test Steps	Target (PSIG)	Actual Readings (PSIG)		Time
		Primary Gauge	Secondary Gauge	
(1) Pressure On	7,150	7225	7200	1:24 PM
(2) Pressure Off	7,225	7225	7200	1:58 PM
Test Completed By	Jhadley	Witnessed By		Ken Grist
Employee #	685	Employee #		128
AI Acceptance (when req'd):		Date:		

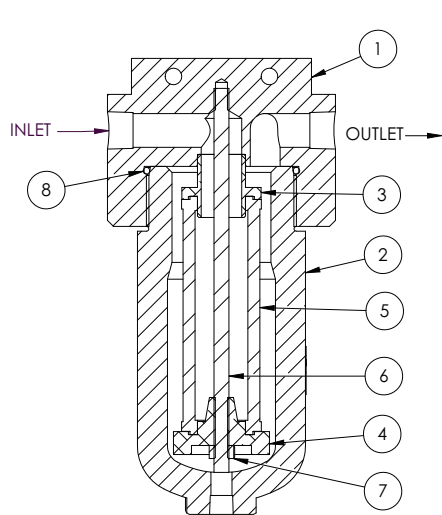
NOTES

RESULTS
Pressure gauge(s) used were calibrated and traceable to National and/or International Standards. IMW hereby certifies the UUT stated above was tested with the following results: <ul style="list-style-type: none">✓ Valid Pressure Gauge(s) Used✓ Heat Numbers Verified✓ Test Pressure Attained✓ Test Pressure Maintained✓ Test Duration Attained✓ Hydrostatic (water) Test Type Confirmed
PASS
Report Completed By: kgrist Report Date: 2011/03/04

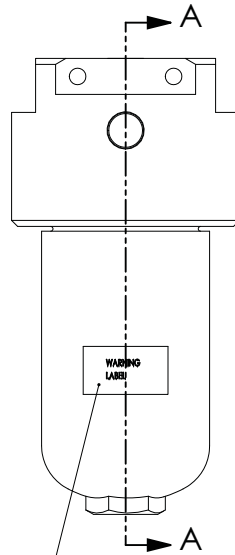
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FOR MANUFACTURE OR SALE OF
APPARATUS WITHOUT
PERMISSION.

REVISION HISTORY

C	2003-11-21	KH	2759-00REV.DOC
D	2005-12-06	SDM	UPDATED ASME CALCS. - ADDEDNDA 2005
E	2007-01-22	DY	UPDATED ASME CALCS. LATEST ADDENDA
F	2008/07/08	EDL	UPDATED BOM, ADDRESS & STANDARDS BLOCKS



SECTION A-A
SCALE 1 : 2



APPLICATION DESIGN CODE
- 2007 ASME BOILER AND PRESSURE VESSEL CODE
SECTION VIII, DIVISION 1, LATEST ADDENDA
- CSA B51-03, BOILER, PRESSURE VESSEL, AND
PRESSURE PIPING CODE

DNE REQUIREMENTS
HYDROSTATICALLY TEST AT 1.3 TIMES
THE DESIGN PRESSURE

DESIGN SPECIFICATIONS
DESIGN PRESSURE: 5500 PSIG
DESIGN TEMPERATURE: -20°F - 200°F

INFORMATION ON FILTER LABEL
IMW COMPRESSORS
43676 PROGRESS WAY, CHILLIWACK, B.C.
CANADA, V2R 0C3, PHONE 604-795-9491

MODEL: CF5500-5-CS
SERIAL No: T8A
FILTRATION: 0.3 MICRON PART. RETENTION
M.W.P.: 5500 PSIG
ELEMENT: GFN-007
CRN: 0H06431.21

PERFORMANCE DATA OF THE FILTER
WORKING MEDIUM: SWEET NATURAL GAS
PER NFPA 52-2006
MAXIMUM WORKING PRESSURE: 5500 PSIG
WORKING TEMPERATURE: -20° TO 200°
MAXIMUM FLOW RATE:
440 SCFM @ 3000 PSIG WORKING PRESSURE
500 SCFM @ 3600 PSIG WORKING PRESSURE
540 SCFM @ 4000 PSIG WORKING PRESSURE
580 SCFM @ 4500 PSIG WORKING PRESSURE
610 SCFM @ 5000 PSIG WORKING PRESSURE
MAX. PRESSURE DROP WITHOUT ELEMENT: 4 PSIG
INTERNAL VOLUME: 0.015 CUBIC FEET

CF5500-5-CS
MATERIAL: CARBON STEEL
ELEMENT LENGTH, INCH
DESIGN PRESSURE, PSIG
COALESCING FILTER

- NOTES
1. STAMP "INLET" ON INLET SIDE OF HEAD, "OUTLET" ON OUTLET
SIDE OF HEAD, "FLOW DIRECTION ARROW" ON BOTH INSTALLATION
SURFACES.
2. WARNING LABEL SHOULD BE ATTACHED TO THE BOWL .
3. BOWL TO HEAD TIGHTENING TORQUE: 30±5 FT-LBS.
4. THIS FITTING DESIGN HAS BEEN REGISTERED AND GIVEN A CRN NUMBER 0H06431.2.
ANY REVISIONS REQUIRE THE DESIGN TO BE RESUBMITTED FOR APPROVAL.
THIS REGISTRATION EXPIRES IN SEPTEMBER 2018.

CERTIFIED BY
IMW INDUSTRIES LTD.

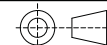
MAWP 5500 PSI AT 200°F
MDMT -20°F AT 5500 PSI
MFG. SERIAL NO. _____
YEAR BUILT _____

CRN 0H06431.21

EXPIRES SEP. 2018

ITEM NO.	QTY	PART NUMBER	DESCRIPTION	SIZE	UOM	SPEC.	WEIGHT
1	1	202579-01	CF 5500-5-CS FILTER HEAD	n/a	EA	CS SA-105	12.7998
2	1	202579-02	CF 5500-5-CS FILTER HOUSING	n/a	EA	n/a	10.89
3	1	201773-04	CF-5500-5-SS ELEMENT COVER	n/a	EA	n/a	0.144
4	1	201773-05	CF-5500-5-SS FILTER ELEMENT SEAT	n/a	EA	n/a	0.06
5	1	319423	ROD REDI CS GR.2 0.3125UNC X 120.000 ZN	8.0	IN	n/a	0.17
6	1	317989	FILTER ELEMENT 1 MICRON COALESCING	n/a	EA	n/a	1.50
7	1	307233	NUT HEX CS GR.5 0.313UNC ZN	n/a	EA	Gr. 5	0.002
8	1	305555	ORING 2-234 V90D	n/a	EA	VITON	0.00
9	1	201773-06	CF-5500-5-SS FILTER WARNING LABEL	n/a	EA	n/a	0.0

DIMENSIONING & TOLERANCING PER
ASME Y14.5M-1994. U.S.O.:



IMW Industries Ltd.
Chilliwack, B.C., Canada

TITLE				COALESCING FILTER CF5500-5-CS	
UNITS	INCHES	X/X	±1/16	SIZE	FILE: NO.
FINISH	64 MICRO IN.	X	±.1	REF. I STANDARD	202579-00
INNER RADI	.03 MAX.	.XX	±.01	DR. ISP	2001-07-26
OUTER	.03 MIN.	.XXX	±.005	C.K. I	
EDGE	X 45°	ANGLES	±.5	AP. I	
SCALE 1:2		WEIGHT 25.578 LBS		SHEET 1 / 1	



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I hereby certify that this document is contained in the records of this company.

• In the event of a report of a work-related product or
vehicle in our possession.

2244

PART NO

8/14/2009

2C0385	1008103
Special Bar Quality	3CC05300249A5A8
ASTM A105/A350	MM09100826
6" Round	MM09100826C2
5" Round 20" A105AL Nucor A105 BK	G1-201752
A105AL Nucor A105	G1-100488

I hereby certify that the material described herein has been manufactured in accordance with the specifications and standards listed above and that it satisfies those requirements.

4 bane minimum per bundle/2 lags per bundle
Call for appl 24 hr in advance 708-345-8180 x160
Lags include size, grade, shape, length, m bundle wt, & heat
bundles to be separated by 4 x4 blocking both horizontal & vr
Trucks must be tarped
Packing slips for rail fax to 708-345-9926

C	Mn	P	S	Si	Cr	Mo	Cu	Al	V	Ni	Cb
0.19%	1.07%	0.008%	0.003%	0.17%	0.10%	0.02%	0.16%	0.032%	0.005%	0.06%	0.001%
Ti	N	Sn	B	H							
0.001%	0.0059%	0.008%	0.0022%	1.3 ppm							

Yield 1: 41800 (289) Psi (MPa) ✓

Reduction of Area: 58.54 %.

Reduction Ratio 7.3:1

Tonelle 1: 73500 (507) Pq: (MPu)

Grain Size per ASTM E112 = 7

Elongation: 30.6 %ln 2" (1/4 in 50.8mm)

Brinell: 147.000

ASTM E281

Center: 2 Mid Radius: 2 Surface: 1

Specification Comments: CERTIFIED TO EN 10204 3.1

1. All manufacturing processes, including molding have been performed in the U.S.A.
2. Mercury, in any form, has not been used in the production or testing of this material.
3. Welding or weld repair was not performed on this material.
4. This material conforms to the specifications described on this document and may not be reproduced except in full, without written approval of Nucor Corporation.
5. This product is NAFTA certified under Paragraph "B" of the NAFTA rule of origin.

John K. Smiley

Yazın Eylisizer

Division Metallurgist

Page 2 of 2

NSAID-144/12, ZCSH



Corus UK Ltd.
Corus Engineering Steels
PO Box 50,
Aldwarke Lane,
Rotherham, S60 1DW,
United Kingdom
Telephone: +44 (0)1709 371234
Fax (main): +44 (0)1709 826233
Website: www.corusgroup.com

INSPECTION CERTIFICATE/TYPE 3.1 to BS EN10204

CORUS AMERICA INC
475 NORTH MARTINGALE DRIVE
SUITE 400 SCHAUMBURG
ILLINOIS 60173 - 2222
USA

HT

Cast No. K1445A

Works Order No. CB817023

Customer Order No. P101070 (121091)

Date of Issue 22-JUL-2010

Certificate No. 00278388/1

Page No. 1 of 5

SPECIFICATIONS ASSOCIATED WITH THIS ORDER -
LF2 TO ASTM A350 + (7) ADDITIONAL SPECS K1445A
NACE MR0175 2003 CARBON
ASTM A696; 90A(R2006) GRADE C
ASME SA-696 REV.04 GRADE C
ASTM A105;/A105M REV.09
ASME SA105;/SA105M REV.A06
ASTM A350;/A350M REV.07 LF2
ASME SA-350;SA-350M REV.A06 LF2
API 6A EDN.19-Er3 36K CLASS L PSL3

PRODUCT INFORMATION -

SIZE - 6.25"

QUANTITY/WEIGHT - As per invoice

CONDITION OF MATERIAL - COLD STR, NORMALISED, SM TURN

STEELMAKING PROCESS/PROCESS OF MANUFACTURE - Electric VDG Ingot

HEAT TREATMENT OF MATERIAL -

Normalise at 880°C; for 02:00; Air Cooled.

ANALYSIS -

Cast No	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	Sn	Nb	V
Cast Analysis												
K1445A	.165	.20	1.27	.012	.011	.12	.03	.09	.12	.014	< .001	< .001



Corus UK Ltd,
Corus Engineering Steels
PO Box 50,
Aldwinkle Lane,
Rotherham, S60 1DW,
United Kingdom.
Telephone: +44 (0)1709 371234
Fax (main): +44 (0)1709 826233
Website: www.corusgroup.com

INSPECTION CERTIFICATE/TYPE 3.1 to BS EN10204

Cast No. **K1445A**

Works Order No. CB817023

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Date of Issue 22-JUL-2010

Certificate No. 00278388/1

Page No. 2 of 5

Mechanical Test - Tested to ASTM A370 09a(E1) / ASTM E8 08

Material Specification ASTM **A105**

Test No.	Ingot Id	Ingot Pos.	Sample Pos.	Orient	Temp.	0.2% PS	U.T.S	Elong	R of A	Hardness	Hardness
					C	PSI	PSI	%	%	HBW10/3000	HBW10/3000
1449257	37	M	Mid-Radial	Lo	23	40200	74500	37.0	70.7	163	163

Mechanical Test - Tested to ASTM A370 09a(E1)

Material Specification ASTM A350-97

Test No.	Ingot Id	Ingot Pos.	Sample Pos.	Orient	Temp.	0.2% PS	U.T.S	Elong	R of A
					C	kPSI	kPSI	%	%
1449258	37	M	Mid-Radial	Lo	23	40.2	74.6	37.0	70.7

Impact Test - Tested to ASTM E23 07a(E1)

Material Specification ASTM A350-97

Test No.	Ingot Id	Ingot Pos.	Sample Pos.	Geometry	Orient	Temp.	Imp Mean	Impact	Impact	Impact
						F	FTLbs	FTLbs	FTLbs	FTLbs
1449259	37	M	Mid-Radial	CH2MMV	Lo	-50	55	32	99	34

Mechanical Test - Tested to ASTM A370 09a(E1)

ASTM A696 90A(REAPPROVED 1995)E1

Test No.	Ingot Id	Ingot Pos.	Sample Pos.	Orient	Temp.	0.2% PS	U.T.S	Elong	R of A
					C	PSI	PSI	%	%
1449257	37	M	Mid-Radial	Lo	23	40200	74500	37.0	70.7

HOT ROLLED RO. 5.0000 X 20" R/L
PART NO.

PO/Rel B100882

I hereby certify that this data is correct as
contained in the records of this company.
I hereby certify that no mercury came in contact

Certificate of Mill Test Resu.

SO 1 -204096-001

250c,
Pg 1/1

with or no weld repair was done to this product
while in our possession.
Attn:

Mill Certification 8/14/2009

PO # 19658

200955	100810.7
Special Bar Quality	30005000240ASA8
ASTM A105/A350	MM09100825
5" Round	MM0910082501 HT#
5" Round 20' A105AL Nucor A105 BK	G1-201788
A105AL Nucor A105	G1-100437
	KREHER PO 19658

I hereby certify that the material described herein has been manufactured in accordance with the specifications and standards listed above and that it satisfies those requirements.

4 bars minimum per bundle/2 tags per bundle
Call for appt 24 hr in advance 708-345-8180 x160
tags include size, grade, shape, length, m bundle wt, & heat
bundles to be separated by 4 x4 blocking both horizontal & vr
Trucks must be tarpred.
Packing slips for rail fax to 708-345-9986

C	Mn	P	S	Si	Cr	Mo	Cu	Al	V	Ni	Cb
0.18%	1.04%	0.008%	0.005%	0.18%	0.11%	0.02%	0.16%	0.029%	0.005%	0.05%	0.001%
Ti	N	Sn	B	H							
0.001%	0.0075%	0.003%	0.0002%	1.0 ppm							

Yield 1: 41800 (288) Psi (MPa)

Reduction of Area: 53.8 %

Reduction Ratio: 7.3 :1

ASTM E381

Center: 2 Mid Radius: 2 Surface: 1

Tensile 1: 74700 (515) Psi (MPa)

Grain Size per ASTM E112 = 7

Elongation: 29.8 % in 2" (% in 50.8mm)

Brinell: 150,000

Specification Comments: CERTIFIED TO EN 10204 3.1

1. All manufacturing processes, including melting have been performed in the U.S.A.
2. Mercury, in any form, has not been used in the production or testing of this material.
3. Welding or weld repair was not performed on this material.
4. This material conforms to the specifications described on this document and may not be reproduced except in full, without written approval of Nucor Corporation.
5. This product is NAFTA certified under Paragraph "B" of the NAFTA rule of origin.

Todd K. Smilg

Todd Eviszior
Division Metallurgist

Page 1 of 1

NSM040 May 12, 2009



IMW INDUSTRIES

43676 PROGRESS WAY CHILLIWACK B.C. CANADA

COMPRESSOR SKID NAMEPLATE

MODEL NUMBER

SERIAL NUMBER

DATE OF MANUFACTURE

INLET PRESSURE

MAXIMUM DISCHARGE PRESSURE

FLOW PER COMPRESSOR
(AT 638 PSIG)

COMPRESSOR SPEED (RPM)

CYLINDER CONFIGURATION

FULL LOAD AMPS

MAIN MOTOR POWER

VOLTAGE

PHASE

FREQUENCY

TEMP CODE

TAMB

INTERNAL ELECTRICAL COMPONENTS
SUITABLE FOR:

REMARKS

MADE IN CANADA



IMW INDUSTRIES

43676 PROGRESS WAY CHILLIWACK B.C. CANADA

PLC/MCC PANEL NAMEPLATE

PANEL TYPE

PANEL SERIAL NUMBER

PANEL MFG DATE

MAIN DRIVER POWER

VOLTAGE PHASE

FULL LOAD AMPS FREQUENCY

REMARKS

ELECTRICAL CLASSIFICATION

MADE IN CANADA

IMW PART #
319618

Dimensions: 4.75 in x 5.5 in