OWNER NAME: TAHERA DIAMOND CORPORATION

PROJECT & SITE: JERICHO DIAMOND PROJECT
NUNAVUT TERRITORY, CANADA

INQUIRY: 316996-CG-501, REV. 3

INQUIRY NAME: FUEL FARM - SUPPLY AND INSTALLATION

QUANTITY REQUIRED: N/A

EQUIPMENT NO.: N/A

2005-02-01	CONSTRUCTION	J.-C. Paradis	3
2005-01-18	CONSTRUCTION	J.-C. Paradis	2
2004-12-23	INFORMATION	K. LEMCELLI	1
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K. LEMCELLI	2004/11/22
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J.-C. PARADIS	2004/11/22
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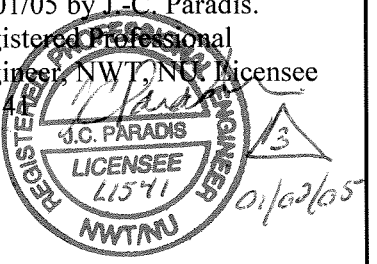
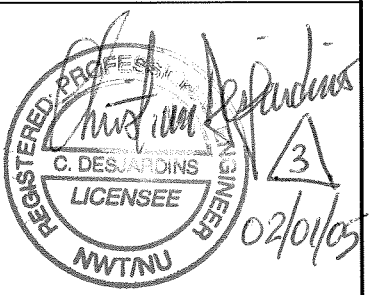
DATE:	2004-12-23		2005-02-01
BY:	J-C PARADIS		J.-C. Paradis

Type of Work	**Responsible**	**Seal**
Civil	Hossein Khalili	Revision 2 signed and sealed on 19/01/05 by Hossein Khalili. Registered Professional Engineer, NWT, NU. Licensee L1545
Piping	Jean-Claude Paradis	Revision 2 signed and sealed on 19/01/05 by J.-C. Paradis. Registered Professional Engineer, NWT, NU. Licensee L1541 
Electrical	Christian Desjardins	

ATTACHMENTS FORMING PART OF THIS EQUIPMENT SPECIFICATION:

Number	Rev.	Title / Description	
SECTIONS :			
01010	2	SCOPE OF WORK	3
01065	1	SITE CONDITIONS	
09911	0	PAINT CODE	
15050	0	PIPING INSTALLATION	
C1D1	3	PIPING MATERIALS, SERVICES LDO	3
16040	0	ELECTRICAL INSTALLATION (To Follow)	3
16050	0	BASIC ELECTRICAL REQUIREMENTS	3
DRAWINGS :			
CIVIL			
150-09-0001	1	DIESEL FUEL FARM CONTAINMENT BASIN LAYOUT	3
150-09-0002	1	DIESEL FUEL FARM CONTAINMENT BASIN SECTIONS	3
EBA FILE:1100060.002		DESKTOP GEOTECHNICAL ASSESSMENT	
Reference drawing # 010-01-0002	P3	Site Grading Plan	3
Reference drawing # 010-01-0005	P3	Site Grading Sections	3
ELECTRICAL			
150-03-0001	0	DIESEL FUEL FARM ELECTRICAL AND GROUNDING LAYOUT GENERAL ARRANGEMENT AND DETAILS	3
Ref. drawing 140-03-0001	P2	TYPICAL UTILIDOR CABLE TRAYS CROSS SECTION	3
048-03-0027	0	GROUNDING INSTALLATION DETAILS	3
Ref. drawing 316996-DF-PM503-011	0	DISPENSING FUEL MODULE ELECTRICAL WIRING DIAGRAM	3
Ref. drawing 316996-DF-PM503-012	0	DISPENSING FUEL MODULE CUTLER HAMMER HEAVY & LIGHT FILL CONTROLLERS WIRING SCHEMATIC	3
Ref. drawing 316996-DF-PM503-006	0	UNLOADING/TRANSFER FUEL MODULE ELECTRICAL WIRING DIAGRAM	3

Ref. drawing 316996-DF-PM503-007	0	UNLOADING/TRANSFER FUEL MODULE CUTLER HAMMER UNLOADING & TRANS. CONTROLLERS WIRING SCHEMATIC	3
MECHANICAL			
316996-DF-PM500-001 (GEM-TAH-01)	A	TANK LAYOUT – 500 M^3 TANKS	
316996-DF-PM500-002 (GEM-TAH-02)	A	GENARAL TANK DETAILS	
316996-DF-PM500-003 (GEM-TAH-03)	A	LADDER & PLATFORM DETAILS	
1500 M^3 TANK	*		
INTERMEDIATE DAY TANKS		GENERAL PLAN AND ORIENTATION FOR 12’ X 20’ LONG TANK	3
Ref. drawing 316996-DF-PM503-001	0	UNLOADING/TRANSFER FUEL MODULE PROCESS FLOW DIAGRAM	3
Ref. drawing 316996-DF-PM503-002	0	UNLOADING/TRANSFER FUEL MODULE PROCESS FLOW DIAGRAM	3
Ref. drawing 316996-DF-PM503-003	0	UNLOADING/TRANSFER FUEL MODULE GENERAL ARRANGEMENT DRAWING PLAN VIEW, SHEET 1 OF 3	3
Ref. drawing 316996-DF-PM503-004	0	UNLOADING/TRANSFER FUEL MODULE GENERAL ARRANGEMENT DRAWING SHEET 2 OF 3	3
Ref. drawing 316996-DF-PM503-005	0	UNLOADING/TRANSFER FUEL MODULE GENERAL ARRANGEMENT DRAWING SHEET 3 OF 3	3
Ref. drawing 316996-DF-PM503-008	0	DISPENSING FUEL MODULE GENERAL ARRANGEMENT DRAWING SHEET 1 OF 3	3
Ref. drawing 316996-DF-PM503-009	0	DISPENSING FUEL MODULE GENERAL ARRANGEMENT DRAWING LIGHT FILL, SHEET 2 OF 3	3
Ref. drawing 316996-DF-PM503-010	0	DISPENSING FUEL MODULE GENERAL ARRANGEMENT DRAWING HEAVY FILL, SHEET 3 OF 3	3

PIPING		
150-04-0001	1	DIESEL FUEL FARM PIPING LAYOUT PLAN AND SECTIONS
150-04-0002	0	DIESEL FUEL FARM PIPING LAYOUT DETAILS
P&ID		
150-06-0101	0	DIESEL FUEL FARM PIPING AND INSTRUMENTATION DIAGRAM
PIPING ISOMETRICS		
050-04-211A-C1A1-1	0	Isometric drawing line 050-211A-LDO-150-C1A1 (Jacket Pipe)
050-04-211-C1D1-1	0	Isometric drawing line 050-211-LDO-80-C1D1
050-04-210-C1D1-1	0	Isometric drawing line 050-210-LDO-80-C1D1
150-04-209-C1D1-1	0	Isometric drawing line 150-209-LDO-80-C1D1
150-04-208A-C1A1-1	0	Isometric drawing line 150-208A-LDO-150-C1A1 (Jacket Pipe)
150-04-208-C1D1-1	0	Isometric drawing line 150-208-LDO-80-C1D1
150-04-207-C1D1-1	0	Isometric drawing line 150-207-LDO-80-C1D1
150-04-206-C1D1-1	0	Isometric drawing line 150-206-LDO-80-C1D1
150-04-205-C1D1-1	0	Isometric drawing line 150-205-LDO-100-C1D1
150-04-204-C1D1-1	0	Isometric drawing line 150-204-LDO-100-C1D1
150-04-203-C1D1-1	0	Isometric drawing line 150-203-LDO-100-C1D1
150-04-202-C1D1-1	0	Isometric drawing line 150-202-LDO-100-C1D1
150-04-201-C1D1-1	0	Isometric drawing line 150-201-LDO-100-C1D1
150-04-200-C1D1-1	0	Isometric drawing line 150-200-LDO-100-C1D1
150-04-199-C1D1-1	0	Isometric drawing line 150-199-LDO-100-C1D1
150-04-198-C1D1-1	0	Isometric drawing line 150-198-LDO-100-C1D1
150-04-197-C1D1-1	0	Isometric drawing line 150-197-LDO-100-C1D1
150-04-196-C1D1-1	0	Isometric drawing line 150-196-LDO-100-C1D1
150-04-195-C1D1-1	0	Isometric drawing line 150-195-LDO-100-C1D1
150-04-194-C1D1-1	0	Isometric drawing line 150-194-LDO-100-C1D1
150-04-193-C1D1-1	0	Isometric drawing line 150-193-LDO-100-C1D1
150-04-192-C1D1-1	0	Isometric drawing line 150-192-LDO-100-C1D1
150-04-191-C1D1-1	0	Isometric drawing line 150-191-LDO-100-C1D1
150-04-190-C1D1-1	0	Isometric drawing line 150-190-LDO-100-C1D1
150-04-189-C1D1-1	0	Isometric drawing line 150-189-LDO-100-C1D1
150-04-188-C1D1-1	0	Isometric drawing line 150-188-LDO-100-C1D1
150-04-187-C1D1-1	0	Isometric drawing line 150-187-LDO-100-C1D1
150-04-186-C1D1-1	0	Isometric drawing line 150-186-LDO-100-C1D1

* DRAWING TO FOLLOW

END OF SECTION

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1. PURPOSE OF THE CONTRACT

1.1 This contract covers material supply and installation for the Jericho Diamond Project fuel farm, located in the Nunavut Territory, on the north arm of Contwoyto Lake, approximately 350 km southwest of Ikaluktutiak and 420 km northwest of Yellowknife. The work includes the installation of Contractor supplied equipment and materials where called for in this contract, and the installation of Owner supplied equipment and materials. This contract covers the following disciplines: civil, electrical, mechanical and piping.

1.2 This Contract also covers the supply and installation of generators' fuel piping from the power plant day tank to each generator diesel tank.

1.3 General Responsibilities of the Contractor

1.3.1 The Contractor shall be responsible for providing all labour, materials, equipment, tools and supervision to unload, lift, assemble, erect, install, connect, align, field test, calibrate, paint and place into service (Phase I commissioning) the equipment and materials supplied by the Owner and Contractor. All mobilization and demobilization requirements for all aspects herein shall be included in the work. The installation as described in the contract shall be performed by the Contractor to the satisfaction of the Owner.

1.3.2 The Contractor shall thoroughly study the drawings and specifications to become familiar with the scope of work, schedule, method of shipment of equipment and materials, and erection procedures. The Contractor shall co-ordinate the activities with the Owner and the Equipment Vendor Representatives during the installation.

1.3.3 The Contractor shall be responsible for the supply of spreader beams where required for the purpose of lifting process equipment.

1.3.4 Any additional requirements for Equipment Vendor Representatives during installation shall be requested from the Owner by the Contractor at least six (6) weeks ahead of the required date. The Contractor shall co-operate with such representatives and the provision of specialists shall not affect the Contractor's responsibility for the completion of the work.

1.3.5 All fasteners, including fasteners for supports are to be supplied by the Contractor unless noted otherwise. All fasteners installed by the Contractor are to be fully painted after installation to provide protection from corrosion.

1.3.6 The Contractor shall be responsible for receiving, unloading, storing, protecting and handling Contractor and Owner-supplied equipment and materials as described in this specification. The Contractor shall provide a schedule to the Owner indicating deliveries of Contractor-supplied equipment, materials, or component parts supplied under the contract. A schedule indicating expected delivery date of Owner-supplied equipment is included in this Contract. The Contractor shall inspect all received materials, including those supplied by the Owner, and report, by writing, all defect and/or damage to the Owner. 3

1.3.7 The Contractor referred to in this document refers to either the General Contractor (Clark Builders) or the Civil Contractor (Nuna Logistics). Responsabilities of both Contractors are as follows:

Activities	Phase 1	Phase 2
Site preparation	Civil Contractor	General Contractor
Civil (including dike construction)	Civil Contractor	General Contractor
Tank installation	Civil Contractor	Gem Steel (field fabrication)
Mechanical	General Contractor	General Contractor
Piping	General Contractor	General Contractor
Electrical	General Contractor	General Contractor

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1.4 The Contractor shall provide for all general services requirements such as temporary lighting, temporary heating, extension cords, welders, portable generators, mobile cranes, fuel supply required before diesel is delivered on site, and tools required to perform the included work.

2. HEALTH AND SAFETY

2.1 General

2.1.1 Personal protection equipment (PPE), such as safety boots, safety glasses and helmets are required at all time on site. Because of the harsh climatic conditions existing during the period of January to March, specialized protection equipment may be required. The Contractor is responsible to supply all PPE.

2.1.2 Particular Risks

- ➢ Exposure to extreme cold weather;
- ➢ Exposure to wind;

2.2 All incidents, anomalies and accidents shall be reported immediately to the site manager.

2.3 All workers using mobile and/or lifting equipment shall have followed all required courses and have a current competency card (or permit) for the type of work involved.

2.4 The Contractor shall follow all health and safety rules applicable in Nunavut. Particular attention shall be given to the following aspects:

2.4.1 Fall protection;

2.4.2 Heavy vehicle circulation near workplace;

2.4.3 Welding;

2.4.4 Working at height;

2.4.5 Lifts requiring lifting plan;

2.4.6 Locking procedures (such as electrical, pneumatic and hydraulic pressure). 3

2.5 Prevention Program

2.5.1 The Contractor shall supply for review to the Engineer or site manager the prevention program that will be used for the work described in this Specification. This program shall be specific to the scope of work of this contract and shall identify all potential incidents and which steps will be taken to avoid these incidents.

2.6 New Equipment

2.6.1 Specific security measures may be mentioned in the installation, operation and maintenance manuals of each new equipment. Before beginning the work related to these equipments, the Contractor shall read and understand them all.

2.7 Fire Protection

2.7.1 No fire protection system will be on site at the time of the work described in this Specification. The Contractor is responsible for bringing portable fire extinguishers, portable water pump, hoses, non-flammable blankets, etc, that may be required to help fight a fire. The Contractor personnel shall be trained in fire fighting methods. Actions shall be taken to minimize fire risks, such as when welding and/or torch cutting.

2.8 Housekeeping

2.8.1 The Contractor is responsible of his work area and shall dispose of its trash in a well-defined and delimited area. The Contactor shall ensure that piling of trash material does not pose a security hazard to the workers on site.

2.8.2 The Contractor shall ensure that the work area is kept clean and that materials and equipment are laid out in such a way as to not cause a security hazard.

3. CODES AND NORMS

3.1 General

3.1.1 The work shall be in accordance with this specification, reference specifications, drawings, equipment data sheets, and applicable codes and standards including the following: the Contractor shall be responsible in obtaining the standards as required.

- ➢ Codes and standards as listed in section 15050
- ➢ Codes and standards as listed in section 16050

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3.1.2 The latest editions of the Codes and Standards shall be used.

3.1.3 The work shall comply with all local and territorial codes, regulations and ordinances for which this type of work applies at the time and execution of the said works. In the event of conflict between reference codes and standards, drawings, and/or specifications, the Contractor shall obtain clarification before proceeding with the work.

4. SCOPE OF WORK

The fuel farm will be constructed in two (2) phases. The work in each phase is described by discipline. The Contractor is responsible to coordinate all sub-contractors that may be required to perform the work described. Responsibilities are indicated in brackets.

4.1 Phase 1 Work Summary

Phase 1 includes:

- ➢ Site preparation (Civil Contractor);
- ➢ Installation of the HDPE liner (Civil Contractor);
- ➢ Erection of the dike (Civil Contractor);
- ➢ Supply and installation of all electrical cables, including grounding cables (General Contractor);
- ➢ Installation of eight (8) tanks, 500 m^3 capacity each (Civil Contractor);
- ➢ Installation of two (2) day tanks, 64 m^3 capacity each (General Contractor);
- ➢ Installation of one (1) unloading and transfer fuel module (General Contractor);
- ➢ Installation of one (1) dispensing fuel module (General Contractor);
- ➢ Supply and installation of all interconnecting piping between the fuel farm, the fuel modules, the day tanks and the power plant (General Contractor).

Both fuel modules are complete with all necessary pumps, piping, electrical panels, motors and valves, HVAC, lighting. Refer to attched reference drawings for details. △3

4.2 Phase 2 Work Summary

Phase 2 includes :

- ➢ Installation of the HDPE liner (General Contractor);
- ➢ Erection of the dike (General Contractor);
- ➢ Supply and installation of all electrical cables, including grounding cables (General Contractor);
- ➢ Site erection of four (4) tanks, 1500 m^3 capacity each (Gem Steel);

- ➢ Supply and installation of all interconnecting piping between the site erected tanks and the phase 1 piping (General Contractor).

4.3 Civil (Phase 1)

4.3.1 The work includes the area of the fuel tank farm, Phase1, the day tank area, the fuel module areas and the truck unloading and loading area.

4.3.2 The contractor shall follow the recommendations found in the attached Geotechnical Assessment Report prepared by EBA Engineering Consultants Ltd. The recommendations found in the EBA report are limited (see explanatory notes in the report) and the construction details may have to be modified following observations and/or testing on site at the time of the construction work. The contractor shall cooperate fully and follow any additional recommendations of representatives of EBA who are present on site during the construction work.

4.3.3 As mentioned in the EBA report, all locally available fill materials shall be carefully selected and sorted so as to ensure their soundness, their workability and compatibility and freedom from ice and snow. The Contractor must not place any fill materials on top of snow or ice.

4.3.4 Supply, place and properly compact all crushed stone and/or local sand and gravel for the liner bedding and berm construction to the proper elevations as shown on the drawings and described here-in.

4.3.5 Supply, place and properly compact the bedding located just below the HDPE liner. The particles in the material used must be well rounded in order not to puncture the liner. If there is no appropriately rounded material available, the contractor must then supply and install a heavy weight 16 ounces (8 ounces on the berms) non-woven fabric geotechnical membrane just below the HDPE liner.

4.3.6 Purchase the HDPE tank farm liner (see Purchase order number 316996-PM-504), accept delivery at the manufacturer and transport the liner to the construction site. The liner manufacturer, as part of the Purchase order PM-504, will furnish technical representatives who will be on site to supervise, assist and approve the liner installation. The contractor will be responsible for any damages to the liner following his acceptance of delivery from the manufacturer.

4.3.7 Install the fuel tank farm pre-purchased HDPE liner on the prepared bedding and anchor the perimeter at the top of the dykes, all as per the drawings and following the instructions and recommendations of the liner manufacturer's technical representatives. Construct all joints required in place with the assistance of the manufacturers technical representatives.

4.3.8 Supply and place and compact the properly selected sand and/or gravel protective layer above the liner to the proper elevations and thickness as shown on the drawings and described herein. The particles in the material used must be well rounded in order not to puncture the liner. If there is no appropriately rounded material available, the contractor must then supply and install a heavy weight 16 ounces (8 ounces on the berms non-woven fabric geotechnical membrane just above the HDPE liner. Extreme care shall be taken during the placement and compaction of this layer in order to avoid all damage to the liner. Follow the

recommendations of the liner manufacturers representatives. The contractor will be responsible for repairing any damages to the liner during installation.

4.3.9 Supply and install the HDPE conduits for piping penetrations through the berms. Seal the liner to the conduit leaving sufficient play to accommodate settlement or movement of the berm material.

4.3.10 Supply and place and compact the local sand and/or gravel for the raised tank bases inside the tank farm. Placement and compaction of these bases must be done with extreme care in order to avoid any damage to the liner below.

4.3.11 The contractor shall take any and all measures necessary to protect the liner and dykes from damage during the construction work including but not limited to: construction of temporary access ramps to permit the movement of equipment; placement of any temporary protection above the liner during the works; any other measures required.

4.3.12 The liner manufacturers technical representatives will provide ongoing inspection during the work and final approval of the installation at the completion of the work. The contractor shall cooperate fully with the representatives and perform any corrective works required in order to ensure the full performance and the guarantee of the liner.

4.3.13 Install eight (8) 500m^3 diesel tanks (150-TK-006 to 150-TK-013) inside the dike. Ensure the tank foundations are levelled, free of rocks and other foreign material and do not contain any holes or depressions. The tanks shall be installed as indicated in drawing 150-04-001. Nozzles axis on all installed tanks must be parallel. Lifting of tank shall follow the manufacturer lifting procedures and recommendations. Each tank weights approximately 16000 kg. Tanks will ~~shall~~ be supplied fully assembled and tested by the manufacturer.

4.4 Civil (Phase 2)

4.4.1 The work includes the area of the fuel tank farm, phase 2. All recommendations and directives in section 4.3 apply.

4.5 Electric (Phase 1) △3

4.5.1 The work includes the area of the fuel tank farm, Phase 1, the day tank area, the fuel module areas and the truck unloading and transfer area.

4.5.2 Refer to drawings listed in section 01000 for electrical and grounding layout of fuel farm to complete scope of work.

4.5.3 All drawings clearly show the boundary between phase 1 and phase 2.

4.5.4 Supply and install all cables as shown on drawing 150-03-0001 according to the bulk electrical material list 316996-03-501. Quantities specified in this list are given for information only. The contractor is responsible to measure, supply and install the quantities that he believes is required to complete the installation. In addition, the contractor is also responsible for supplying all necessary equipment such as connectors, c-clamps, lugs, ty-raps

or other hardware that he believes is necessary to properly and efficiently complete the installation.

4.5.5 All grounding and feeder cables shown underground in drawings shall be directly buried.

4.5.6 Supply, install and hook all bonding and feeder cables shown running along fuel conduits which must be tied to the conduits using ty-raps at every 1.5 m.

4.5.7 Grounding cables around dispending and fuel loading/offloading modules shall be laid directly on the ground.

4.5.8 All tanks (including day tanks 150-TK-018 and 050-TK-019) must be tied twice to the fuel farm grounding network as shown on drawing 150-03-0001.

4.5.9 All bonding cables must be bolted on both sides of each piping flange according to detail 11 from drawing 048-03-0027.

4.5.10 Supply, install and hook two flexible grounding connectors for trucks transporting combustible liquids. Connectors will be tied to the grounding loop of the unloading/transfer and dispensing modules, one connector per module as shown on 150-03-0001. The contractor shall also supply two labels (one per connector) with the words “Truck grounding connectors” fixed to the wall of each module to clearly identify the connector hangers. Writing shall be 50mm high (minimum) and be clearly visible.

4.5.11 All pig tails shown on drawing 150-03-0001 shall be tied to main grounding network.

4.5.12 Supply, install and hook 1000 V power feeder for unloading/transfer and dispensing modules. The power will be fed to dispensing module from the electrical room of the maintenance building located on the second floor mezzanine. Feeder will be bottom fed from cell 8E of the main MCC. The contractor will use existing cable trays installed by workshop supplier.

4.5.13 Supply and install a junction box (600 V, 3 phase, 100 A) in the dispensing module to split the main feeder in two feeders of the same cable size (Teck 3c – 2/0 AWG Cu 1000 V). One feeder will supply the distribution panel in the dispensing module while the other will feed the panel from the loading/offloading module. The contractor shall supply both power cables.

4.6 Electric (Phase 2) △3

4.6.1 Refer to drawings listed in section 01000 for electrical and grounding layout of fuel farm to complete scope of work.

4.6.2 Supply and install all cables as shown on drawing 150-03-0001 according to the bulk electrical material list 316996-03-501. Quantities specified in this list are given for information only. The contractor is responsible to measure, supply and install the quantities that he believes is required to complete the installation. In addition, the contractor is also responsible for supplying all necessary equipment such as connectors, c-clamps, lugs, ty-raps or other hardware that he believes is necessary to properly and efficiently complete the installation.

4.6.3 Supply, install and hook all bonding cables shown running along fuel conduits which must be tied to the conduits using ty-raps at every 1.5 m.

4.6.4 All tanks must be tied twice to the fuel farm grounding network as shown on drawing 150-03-0001.

4.6.5 All bonding cables must be bolted on both sides of each piping flange according to detail 11 from drawing 048-03-0027. There will be one area dedicated for this purpose.

4.6.6 During phase 2 construction, the pig tails between phase 1 and 2 shall be tied together. The other pig tail shall be tied to the main grounding network.

4.7 Mechanical and Piping – Phase 1

4.7.1 Ppiping isometrics drawings are listed in section 01000. No field joints or trim allowance are shown. The Contractor is responsible to add any field joint and trim allowance that he feels may be required in order to pre-fabricate piping in the most efficient manner. Once the equipments are installed, the Contractor shall take measurement to insure that piping isometrics are accurate.

4.7.2 All drawings clearly show the boundary between phase 1 and phase 2.

4.7.3 (This section transferred to 4.3.12).

4.7.4 Install day tank 150-TK-018 inside the dike. Ensure tank is levelled and that its main axis is parallel with the other tanks nozzles. Tank 150-TK-018 weights approximately 5000 kg.

4.7.5 Install day tank 50-TK-019 inside the power plant day tank dike. Ensure tank is levelled and that its main axis is parallel with the other tanks nozzles. Tank 150-TK-019 weights approximately 5000 kg.

4.7.6 Install the unloading/transfer fuel module 150-DM-001 as indicated on drawings. Ensure the ground is levelled. Module 150-DM-001 weights approximately 5000 kg. Module is supplied piped, wired and tested by the supplier of this equipment. For startup, follow the recommendations of the unloading/transfer fuel module manufacturer representatives.

4.7.7 Install the dispensing fuel module 150-DM-002 as indicated on drawings. Ensure the ground is levelled. Module 150-DM-002 weights approximately 4000 kg. Module is supplied piped, wired and tested by the supplier of this equipment. For startup, follow the recommendations of the dispensing fuel module manufacturer representatives.

4.7.8 Supply and install piping supports according to drawings 150-04-0001 and 150-04-0002.

4.7.9 Supply and install all piping as shown on the piping general arrangement drawing 150-04-0001 and the Contractor-supplied equipment lists 316996-04-501,316996-04-502 and isometrics (see Appendix A). The contractor shall be responsible to supply all piping material necessary to complete the work. In the case of discrepancies between the material lists and the drawings, the shall ensure the correct quantities are supplied and installed

4.7.10 Shop fabricate as much piping as possible, based on the piping isometric drawings listed in section 01000. No trim allowance or field joints are shown on the isometrics. The Contractor is responsible to place field joints and trim allowance where required to facilitate construction on site.

~~4.7.11 Piping crossing dike walls shall be wrapped in Denso tape Wrapping shall extend 0.5m on each side of the wall. Where Provision shall be done to maintain the liner tight.~~

4.7.12 Piping installed in sleeves crossing the berms shall be sealed using "Link-Seal" or approved equivalent sealing system. Refer to drawing 150-04-0002 for details.

4.7.13 Double-wall pipes installed underground shall be wrapped in Denso tape to protect them against corrosion. Denso tape shall extend at least 300mm above ground.

4.7.14 Supply and install all manual valves as indicated on the piping and instrumentation diagram (P&ID) 150-06-0101 and on the Contractor-supplied equipment lists 316996-04-501 and 316996-04-502.

4.7.15 Supply and install a DN150 carbon steel sleeve to protect the underground diesel piping, as shown on drawing 150-04-0001 and detailed on drawing 150-04-0002. Esker sand shall be backfilled and compacted in 150mm layers, up to the road surface. A red (or other bright colour) visible marking tape shall be put on top of the concrete before backfilling with esker sand. Each layer of 150mm of sand shall be compacted before putting the next one. Visible marker posts shall be installed on each side of crossing roads and at 3 meter intervals, next to the underground pipe. Installation on this underground pipe is to be done only when the roads next to the fuel farm are being done.

4.7.16 P&ID's have priority over piping drawings. In case of conflict between the piping drawings and the P&ID's, the Contractor shall follow the P&ID's.

4.7.17 Vents and drains may not all be shown on P&ID's and piping drawings. The Contractor shall supply and install the materials, including manual valves, required for additional vents and drains. Refer to the piping material specification for suitable material.

4.7.18 Small bore piping (DN15 to DN50) is not necessarily shown on piping drawings, but is shown on P&ID's. The Contractor shall field run this piping according to the P&ID's.

4.7.19 Supply and install required secondary steel for pipe supports and/or equipment installation. All welds on pipe for supports, guides, anchors, etc, shall be continuous fillet weld.

4.7.20 Supply and install all accessories required to complete the work of this Specification, including, but not limited to:

4.7.20.1 Gaskets, stud bolts and nuts required for piping erection, in accordance with piping material specifications. Use suitable anti-seize on all bolted connections.

4.7.20.2 Temporary strainers for testing and commissioning.

4.7.21 Supply and install all piping identification, in accordance with section 09911.

4.7.22 When paint on piping and equipment has been damaged during handling and/or installation, touch-up paint in accordance with section 09911.

4.7.23 Paint all piping in accordance with section 09911.

4.7.24 Test all phase 1 piping pneumatically to 440 kPag in accordance ASME B31.3.

4.7.25 Test all phase 2 piping either pneumatically to 440 kPag or hydrostatically to 600 kPag, in accordance with ASME B31.3.

4.7.26 500 m3 tanks are shop tested and 1500 m^3 tanks, field erected, shall be hydrostatically tested in the summer 2005, in accordance with API-650.

4.7.27 10% of all circumferential butt joints, for both phase 1 and 2 piping, shall be examined in accordance with ASME B31.3.

4.7.28 Submit all test certificates to the Owner.

4.7.29 The Contractor is responsible for designing, supplying, fabricating and installing all pipe supports, including necessary secondary steel, in accordance with section 15050, with the exceptions of supports already shown on drawings. Contractor is still responsible for supplying and installing these supports. All support locations and support drawings shall be submitted to the Owner for review.

4.8 Commissioning

3

4.8.1 The Contractor shall be responsible for stage 1 commissioning. This stage consist of the complete inspection and testing of each piece of equipment individually, including electrical control and power wiring which has been connected to the equipment. It is the Contractor's responsibility to direct and carry out completely this stage of testing and commissioning which relates to his scope of work. The Owner's Representative will provide technical assistance where necessary and will approve the inspections and witness the tests, for which the Owner's Representative will have been notified in advance by the Contractor. 3

4.8.2 The Contractor will provide to the Owner's Representative checklists, data sheets, calibration sheets and tags for each piece of equipment, electrical device, instrument, etc. 3

4.8.3 The Contractor shall designate one representative of his staff to assume all responsibility for the complete inspection and testing of all work within the scope of this specification. 3

4.8.4 The Owner's Representative will approve the check list prepared by the Contractor of all inspections and tests that must be performed before acceptance of the equipment by the Owner. The Contractor will ensure that these are carried out and will keep a record of the results to the satisfaction of the Owner's Representative. 3

4.8.5 The Contractor shall provide manpower as required by the Owner, on a hourly fee basis, for additional comissioning phases. 3

5. MATERIALS

5.1 Supplied by Contractor

5.1.1 The equipment to be supplied by the Contractor is listed in Appendix A "Contractor Supplied Material and Equipment Lists".

5.1.2 An allowance above the required minimum quantity is included in the lists. Each individual list states this allowance. The Contractor must ensure, based on his experience, that the allowance is sufficient. If the allowance is not enough for the type of work involved, the Contractor shall indicate, in writing, the additional required quantities and expected price before proceeding with the purchase. Listed quantities are based on information available, at the time of issuance, from the 3D models, P&ID's and other documents.

5.1.3 When items are identified using a brand name and model number, substitution for other brand and/or model shall not be accepted unless the Contractor submits to the Engineer for his approval, in writing, all information required ensuring that the proposed substitution is equivalent in every aspect.

5.1.4 For pipes, pipe fittings and valves, the Piping Material Specification C1D1 shall take precedence over the descriptions included in Appendix A.

5.2 Supplied by Owner

Materials and Equipment supplied by the Owner is indicated throughout the detailed scope of work sections and Appendix B "Owner Supplied Equipment List".

6. QUALITY ASSURANCE AND CONTROL

The Contractor shall provide its quality control system specific to the work described in this Specification.

7. INFORMATION REQUIRED WITH BID

7.1 The Contractor shall provide prices for each bill item or sub-item as indicated in Appendix A.

7.2 The Contractor shall advise and indicate in detail, any work and/or delivery that are estimated to take longer than the estimated completion milestones.

7.3 The Contractor shall provide a schedule indicating major milestones and expected duration of each task.

7.4 The Contractor shall provide a price for the work in each discipline (by phases). This price shall be ventilated using major tasks, such as HDPE installation, tank installation, etc.

7.5 The Contractor shall indicate any task that may be missing from this Specification but that is required to complete the work described.

APPENDIX A
Contractor Supplied Equipment

List Number	Title	Rev.	Date
316996-04-501	Piping – Bulk Material List – Specification C1D1	2	19/11/04
316996-04-502	Valves, Manual and ON/OFF	1	19/11/04
316996-04-004	316996 Line List	0	17/01/05
316996-03-501	Electrical – Bulk Material List	0	31/01/05

△3

APPENDIX B
Owner Supplied Equipment Lists

Equipment Number	Title	Phase	Supplier
150-TK-006	Vertical tank 500 m3 (Diameter 8.15m, Height 9.75m)	1	Gem Steel
150-TK-007	Vertical tank 500 m3 (Diameter 8.15m, Height 9.75m)	1	Gem Steel
150-TK-008	Vertical tank 500 m3 (Diameter 8.15m, Height 9.75m)	1	Gem Steel
150-TK-009	Vertical tank 500 m3 (Diameter 8.15m, Height 9.75m)	1	Gem Steel
150-TK-010	Vertical tank 500 m3 (Diameter 8.15m, Height 9.75m)	1	Gem Steel
150-TK-011	Vertical tank 500 m3 (Diameter 8.15m, Height 9.75m)	1	Gem Steel
150-TK-012	Vertical tank 500 m3 (Diameter 8.15m, Height 9.75m)	1	Gem Steel
150-TK-013	Vertical tank 500 m3 (Diameter 8.15m, Height 9.75m)	1	Gem Steel
150-TK-018	Horizontal tank 64 m3 (Diameter 3.66m, Long 6.10m)	1	TAHERA
050-TK-019	Horizontal tank 64 m3 (Diameter 3.66m, Long 6.10m)	1	TAHERA
150-DM-001	Fuel unloading module (Container 20’ long)	1	Chamco
150-DM-002	Fuel dispensing module (Container 20’ long)	1	Chamco
150-TK-014	Vertical tank 1500 m3 (Diameter 14.63m, Height 9.75m)	2	Gem Steel
150-TK-015	Vertical tank 1500 m3 (Diameter 14.63m, Height 9.75m)	2	Gem Steel
150-TK-016	Vertical tank 1500 m3 (Diameter 14.63m, Height 9.75m)	2	Gem Steel
150-TK-017	Vertical tank 1500 m3 (Diameter 14.63m, Height 9.75m)	2	Gem Steel
	HDPE LINER (316996-PM-504)		NUNA

END OF SECTION

1. GENERAL

All site and climatic information shall be as specified in the Supplement to the National Building Code of Canada (latest edition) and as specified herein.

2. LOCATION

The plant will be located in the Nunavut Territory, on the north arm of Contwoyto Lake, approximately 350 km southwest of Ikaluktutiak and 420 km northwest of Yellowknife.

3. ELEVATION

Geodetic Elevation is 520 m.

4. REFERENCE LOCATION

Cambridge Bay (TBC) 1995 NBC	Nunavut Territory/ (Northwest Territory)

5. TEMPERATURE

5.1 Outdoors

Minimum temperature:	Winter 1% = -46°C	Winter 2.5% = -43°C
Maximum temperature:	Summer dry bulb (db) = +22°C	Summer Wet Bulb (wb) = +15°C

5.2 Indoors

Minimum temperature:	5°C
Maximum temperature:	35°C
Humidity:	5% - 95% non condensing

6. EARTHQUAKE LOADS*

Acceleration zone, Za :	0	1
Velocity zone, Zv :	1	1
Assigned velocity ratio, V:	0.05	1

7. SNOW LOAD*

Snow load

Ss	2.4 kPa	1
Sr	0.1 kPa	1

8. WIND*

Hour wind pressures (velocity) at ground level:

Wind load	Probability	Data to be used	
q hourly wind pressure	1/100	0.6 Kpa	1
	1/30	0.5 Kpa	1

**Based on the worst condition of the three reference location as per NBC 1995:*

1. *Cambridge Bay, Nunavut Terriroty*
2. *Copper Mine, Northwest Territory*
3. *Yellowknife, Northwest Territory*

Rev	Issued for	Date	Prepared by	Reviewed by	Approved by
1	Design/Construction	04/11/16	S. Bibas 16/11/2004	R. Picotte 16/11/2004	D. Lam 2004/11/16

END OF SECTION

1. GENERAL

This section is applicable to shop painting prior to delivery on-site and for field painting of piping, equipment, structural steel, plate work, safety guards and handrails. This section is also applicable for piping identification.

2. PAINTING SPECIFICATION

2.1 Manufactured Equipment

2.1.1 Equipment shall be supplied with manufacturers standard paint finish and colour.

2.1.2 Paint system shall be appropriate for specified equipment duty and industrial environment.

2.1.3 Unless required by process, all metallic surfaces shall be painted, including equipment supports.

2.1.4 Paint system shall be applied according to manufacturer recommendations for surface preparation, primer and paint application.

2.1.5 Equipment must receive at least 2 coats of paint, a primer coat and a finish coat.

2.1.6 Paint system must have demonstrated acceptable performance for intended application. Under normal operating conditions, paint system should not require recoat before a minimum of 8 years.

2.1.7 Supply a reasonable quantity for touch-up paint at site.

2.2 Piping, Structural Steel and Plate Work

2.2.1 Structural steel shall be supplied to site with a minimum of one (1) coat of steel primer paint.

2.2.2 Carbon steel piping shall be supplied to site with a minimum of one (1) coat of primer and one (1) coat of paint.

2.2.3 Plate Work shall be supplied to site with a minimum of one (1) coat of primer and one (1) coat of paint.

2.2.4 Paint system (primer coat or complete system) shall be sufficient to protect steel and piping during the delivery to site and provide sufficient protection for the steel during the possible six (6) to eight (8) months of exterior storage on site before erection.

2.2.5 Unless specifically noted, all structural steel shall be painted standard medium gray.

2.2.6 Piping colour shall be as per section 4.0.

2.2.7 Piping shall be identified as per section 5.0.

2.2.8 Galvanized steel shall not be painted.

2.2.9 Non-galvanized grating shall be supplied to site with manufacturers standard black paint.

2.2.10 Paint or primer damaged during transportation or during erection shall be touched up. Touch-ups shall be executed according to paint manufacturer recommendations for surface preparation and paint application.

3. EXECUTION

3.1 Surface Conditions Prior to Painting

3.1.1.1 All surfaces must be dried, cleaned and free from grease, oil, rust, burrs and dust.

3.1.1.2 Surface temperature must not be more than 2 °C (35 °F) colder than ambient temperature.

3.1.1.3 Surface temperature must be at least 10 °C (50 °F).

3.2 Painting Application

3.2.1 Paint application shall conform to SSPC-PA1 standards (shop, site and maintenance painting) and to painting manufacturer recommendations.

3.2.2 Primer shall be applied immediately after cleaning to avoid rust formation.

3.3 Painting Thickness

3.3.1 Primer coat: 0.003'' +/- 0.001''

3.3.2 Finish coat : 0.005'' +/- 0.001''

3.3.3 Number of coats to be applied as per paint manufacturer recommendation.

3.3.4 Perform dry film test and submit report to engineer prior to shipping of equipment.

4. COLOURS

Colours for equipment shall be applied as follows:

4.1 Steel Grey: International 71044, or equivalent for:

- ➢ Structural steel;
- ➢ Fabricated plate work.

4.2 Safety Yellow: International 71038 for:

- ➢ Safety guards;
- ➢ Handrails;
- ➢ Kick plates;
- ➢ Ladder cages;
- ➢ Monorails / crawls beams;
- ➢ Moving parts that can project from the equipment.

4.3 Piping Colours

The following table lists piping colour by services:

Service	Colour	International Colour Code (or equivalent)
AP – Plant Air	Light Blue (note 2)	71025
AI – Instrument air	Light Blue (note 2)	71025
LDO – Diesel Oil	Yellow	71039
LLO Lube Oil	Yellow	71039
RFL– Flocculant	Dark Brown	71022
SCD – Dilute Meduim	Light Tan	71021
SCM – Correct Medium	Light Tan	71021
ST – Tailings Slurry	See note 1	
SP – Process Slurry	Light Tan	71021
WGS – Water/Glycol supply	Note 3	
WGR – Water/Glycol return	Note 3	
WPR – Process Water	Green	71014
WR – Raw Water	Green (note 2)	71014
WPT – Potable Water	Green (note 2)	71014
WFR - Fire Protection Water	Safety Red	71007

Note 1: These services do not require painting, identification only to section 5.0.
Note 2: Painting required on carbon steel pipe only.
Note 3: Apply primer only.

5. PIPING IDENTIFICATION

5.1 Identification by Paint (Inside of Building)

5.1.1 Primer

- ➢ Manufacturer's standard, subject to Owner's approval, 2½ mils dry film thickness.
- ➢ For galvanized steel lines, use the appropriate Manufacturer's primer.

5.1.2 Finish

- ➢ Manufacturer's standard, subject to Owner's approval, 2 coats, 2½ mils dry film thickness each.
- ➢ For the colour of piping, see item 4.3, Piping Colours.

5.2 Identification by Labels (Unpainted or Insulated Pipe Only)

5.2.1 For pipe DN200 and smaller, coiled labels shall be used. Suitable material is BRADY type B-689 or approved equivalent.

5.2.2 For pipes DN250 and larger, BRADY type B-681/883 labels or approved equivalent shall be used. Label to be fixed using stainless steel strips.

5.2.3 The colour of the lettering shall comply with item 5.4 hereunder.

5.2.4 The lettering size shall be as follows:

Pipe O.D	Size of lettering
DN15-DN32 (1/2” to 1-1/4”)	13 mm (1/2”)
DN40-DN65 (1-1/2” to 2-1/2”)	19 mm (3/4”)
DN80-DN150 (3” to 6”)	32 mm (1-1/4”)
DN200-DN250 (8” to 10”)	65 mm (2-1/2”)
DN300 (12”) and more	90 mm (3-1/2”)

5.3 Application of Identification

5.3.1 Apply identification as follows:

- ➢ Every 6 m (20 feet) along straight sections of pipes;
- ➢ Near all changes of direction where the length is greater than 3 m (10 feet);
- ➢ Where a pipe passes through a wall (each side of the wall);
- ➢ Near all valves.

5.3.2 Identification shall be applied to the lower half of horizontal pipe to prevent dust build-up from covering the identification.

5.3.3 Locate identification so that it is visible from the nearest floor.

5.3.4 An arrow indicating direction of flow shall always follow identification.

5.3.5 If labels are used, the ends of all labels are to be banded with 57 mm (2¼") self-adhesive coloured banding tapes (colour as per section 5.4).

5.4 Identification Colours

Service	Abbreviation	Colours Labels	Colours Bands	Lettering
AP – Plant Air	Plant Air	Light Blue	Light Blue	White
AI – Instrument air	Inst Air	Light Blue	Light Blue	White
LDO–Diesel Oil	Diesel	Yellow	–	Black
LLO–Lube Oil	Lube	Yellow	Orange	Black
RFL– Flocculant	Floc	Yellow	Yellow	White
SCD – Dilute Meduim	Dilute M.	Blue	White	White
SCM – Correct Medium	Correct M.	Blue	Blue	White
ST – Tailings Slurry	Tailings	Tan	Black	White
SP – Process Slurry	Slurry	Tan	White	White
WGR– Water/Glycol Return	Glycol Ret.	Black	White	White
WGS–Water/Glycol Supply	Glycol Sup.	Black	Black	White
WPR – Process Water	Process W.	Green	Black	White
WR – Raw Water	Raw W.	Green	White	White
WPT – Potable Water	Pot. Water	Green	Blue	White
WFR - Fire Protection Water	Fire Water	Red	Red	White

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0	Design/Construction	04/11/04	S. Bibas J.C. Paradis	8/11/04	2004/11/8

END OF SECTION

Table of Contents

1. GENERAL

1.1 Piping Installation

1.1.1 Codes, Standards & Special Conditions

1.1.1.1 The Contractor shall obtain all permits and inspection required by building, safety code, ordinances, rules and regulations of any legal body having jurisdiction.

1.1.1.2 All work covered by this specification shall be in accordance with the applicable codes and regulations. Nothing shown on the drawings, nor in these specifications, shall be considered as authorizing any installation that violates the requirements of the applicable codes, rules and regulations.

1.1.1.3 The installation shall conform at least to the conditions set out in the latest issues of the following:

- NBC National Building Code
- AISI American Iron and Steel Institute
- ANSI American National Standards Institute (ANSI)
- ANSI B2.1 Pipe Threads -.
- ANSI B16.9 Pipe Fitting Dimensions
- ASME American Society for Mechanical Engineers
- ASME B31.3 Code for Pressure Piping
- ASTM American Society for Testing and Materials
- AWS American Welding Society
- CPMA Canadian Paint Manufacturers' Association
- CSA Canadian Standards' Association
- CSA W59 Structure Welding
- CUA Canadian Underwriters' Association
- CWS Canadian Welding Society
- FM Factory Mutual
- ISA Instrument Society of America
- NEMA National Electrical Manufacturers Association
- NFPA National Fire Protection Association
- NFC National Fire Code of Canada
- RMA Rubber Manufacturers' Association
- SSPC Steel Structures Painting Council
- ULC Underwriters' Laboratories of Canada
- Regulations, Board of Transport Commission of Canada.
- The Occupational Health & Safety Act, 1978 and Regulations for Industrial Establishments.
- The Occupational Health & Safety Act, 1978 and Regulations for Construction Projects.
- All applicable Nunavut Territory codes.

1.1.1.4 Whenever requirements stated in this specification, or on the drawings, exceed the governing standards, codes and regulations, the provisions of this specification and drawings shall govern.

1.1.2 Workmanship

1.1.2.1 Work shall be of first quality and neat in appearance, all workmanship being equal to the best known in the trade.

1.1.2.2 Any material soiled or damaged in the execution of the work shall be thoroughly cleaned, repaired or replaced, in a manner satisfactory to the Engineer.

1.1.3 Coordination and Scheduling

Cooperate with other trades and coordinate this work with work of other trades and contracts. Make adjustments as necessary to accommodate other work that is scheduled or is already in progress.

1.1.4 Manufacturer's Instructions

1.1.4.1 Install the piping and equipment in strict accordance with manufacturer's installation drawings, installation specifications and instructions. The requirements of this specification are complementary to the manufacturer's instructions.

1.1.4.2 The Contractor shall retain at his own cost competent manufacturers' representatives to instruct the Contractor's personnel in proper techniques and procedures, if the Contractor's own forces do not have the necessary experience and expertise.

1.1.5 Connections to Working Plant

1.1.5.1 Some connections may have to be made to existing piping systems of an operating plant. Do not proceed with any work that connects to the existing plant without prior explicit agreement from the Engineer as regards extent and schedule for every part of such work.

1.1.5.2 Get specific authorization from the Engineer for any proposed interruption of service.

1.1.6 Interpretation of Drawings

1.1.6.1 To a degree the drawings are diagrammatic only and therefore do not necessarily show every fitting required. Read drawings with this in mind.

1.1.6.2 Pipe sizes, temperatures and pressures in this specification are shown in metric. All metric sizes are given in millimetres unless noted otherwise.

1.1.7 Brand Names

Brand names, when given, only define type, quality and required characteristics of equipment and material. Equivalent material may be used subject to prior approval

by Engineer. The number of brand names used throughout the project shall be kept to a minimum.

1.1.8 Piping Location

1.1.8.1 Install pipes to dimensioned locations shown on drawings. Check all dimensions in the field before field or shop fabrication is started. Advise Engineer of interferences. Arrange work accordingly making necessary allowances and adjustments.

1.1.8.2 Where interferences arise due to non-observance of location dimensions given on drawings, the work shall be taken down and reinstalled without any extra compensation or delaying of original schedules.

1.1.9 Recording Deviations

Record all piping location and elevation deviations from drawings on a separate set of sepias as the construction progresses. These sepias shall be turned over to the Engineer at the completion of the work.

1.1.10 Field Run Piping

Some piping is shown on piping diagrams only without being shown on orthographic drawings. This piping shall be field run. Route piping in a neat and workmanlike manner. Have routing approved by Engineer before starting work.

1.1.11 Clearances

1.1.11.1 Piping around pumps, heat exchangers and other process equipment shall be laid out so that a clear passage of 760 mm is maintained.

1.1.11.2 Minimum clearance between adjacent underground piping shall be 100 mm.

1.1.11.3 Underground pipes shall not be closer than 400 mm to any major foundation.

1.1.12 Accessibility

Piping will be deemed inaccessible if valve wheels and bolted or other connections are installed so that they cannot be readily operated or opened, or parts cannot be readily removed without dismantling adjacent parts. Inaccessible piping will be refused and will have to be re-routed.

1.1.13 Valve Locations

1.1.13.1 Locate valves as shown on the drawings. Where dimensioned valve locations are not shown on the drawings valves shall be located so that they may be operated from floors or platforms. This applies to field run piping valves also.

1.1.13.2 Where it is not possible or practical to locate valves within reach of plant operators, steam extensions and/or chain wheels shall be provided. This also applies to valves pre-purchased without these devices.

1.1.13.3 Valves with chain wheel operators shall only be used as a last resort.

1.1.14 Valve Tags

1.1.14.1 Provide all valves with permanent 50 mm brass or stainless steel identity tags attached with rings.

1.1.14.2 Stencil valve identification on tags with 10 mm stencils.

1.1.14.3 Identify all valves with its service (fluid) designation. Add valve numbers in the special cases where such numbers are shown on the drawings.

1.1.15 Slopes

Where called for, slope piping uniformly between established elevations and without pockets.

1.1.16 Plumbs and Lines

Unless otherwise called for on drawings all vertical lines shall be plumb, all horizontal lines shall be true to line and level, and parallel to building lines or walls.

1.1.17 Unions

Provide unions and/or flanges in valve trains and at piping equipment so that valves and piping components and equipment can be removed without having to resort to cutting of lines.

1.1.18 Odd Pipe Sizes

Do not use 30 mm (1 1/4"), 65 (2 ½"), 90 (3 ½") and 125 (5") steel pipe unless specifically called for on drawings or equipment connection size makes it necessary. Odd pipe sizes may be acceptable in some special cases providing there are no valves in the lines. These shall, however, be approved by the Engineer prior to installations.

1.1.19 Minimum Size of Lines

Do not use pipe smaller than 20 mm (3/4") unless called for on drawings.

1.1.20 Branch Connections for Different Specification Lines

Where two lines of different specifications join, the "tee" shall be of the "heavier" or more corrosion resistant specification. The "heavier" or more corrosion resistant

specification shall also govern the first isolating valve and pipe up to the first isolating valve on the "lighter" or less resistant line.

1.1.21 Reducers

Fabricated reducers shall not be acceptable. Use of bushings to change line size is not acceptable unless specifically called on the drawings.

1.1.22 Elbows

All elbows shall be long radius unless otherwise specifically called for. Fabricated miter elbows will be accepted only where specifically called for.

1.1.23 Dielectric Fittings and materials

Where non-ferrous pipe is connected to ferrous pipe or equipment, or otherwise comes in contact with ferrous metals, connections shall be made with dielectric fittings and dielectric materials shall be used to isolate the dissimilar metals.

1.1.24 Bolt Holes on Flanges

Bolt holes shall straddle vertical centrelines unless otherwise noted.

1.1.25 Removing Raised Flange Faces

Where raised face flanges are to be mated with flat face equipment or valve flanges, the raised face of line flanges shall be removed.

1.1.26 Mating to Equipment Flanges

Where line flanges are to be mated to equipment flanges they shall be of the same type and rating as the equipment flanges regardless of what flanges are called for in material specifications.

1.1.27 Connections to Equipment

Make connections to equipment so that lines do not impart any stress on equipment due to misalignment. Open connections upon request of the Engineer to demonstrate compliance.

1.1.28 Connections to Pumps

1.1.28.1 Suction piping on pumps to have "Victaulic" type flexible joints if shown on drawings and as specified in material specifications.

1.1.28.2 Spool pieces shall be provided in piping at pumps to facilitate removal of the impeller without dismantling piping or valves.

1.1.28.3 Provision shall be made for draining suction and discharge lines.

1.1.29 Screwed Joints

1.1.29.1 Use tape/dope on screwed joints.

1.1.29.2 Do not use Teflon tape on gas piping joints.

1.1.29.3 On oxygen piping use compounds specifically intended for oxygen service and be sure that all pipe threads are properly degreased before application.

1.1.30 Seal Welding

Do not seal weld threaded connections unless specifically so-called for. Where seal welding is specified for threaded fittings, it shall NEVER apply to valves. Install unions in proximity of valves to allow for their removal.

1.1.31 Tolerances

The following tolerances for fabrication shall be adhered to:

- ➢ Length and other linear dimensions: ±1.5 mm (1/16"). The linear tolerances shall not be accumulative.
- ➢ Flange face alignment: maximum deviation measured in any direction 0.2 mm.
- ➢ Bolt hole location deviation from centreline: ±1.2 mm (3/64").

1.1.32 Blow-offs

Provide blow-off valves for all strainers, except strainers on vacuum service.

1.1.33 Drains and Vents

1.1.33.1 Install all lines completely drainable.

1.1.33.2 All low points and high points of lines, except buried lines shall be provided with valved drains and valved vents even when these drains and vents are not shown on the drawings. Pipe all drains to near floor level and to locations where liquid can run off to floor drains. Where this is not practical, provide fitting for connection of hose.

1.1.34 Grounding

Bond and ground all piping carrying flammable or combustible materials.

1.1.35 Capping of Pipe Ends

Temporarily plug and cap ends of all piping, valves, etc. on which work is not in progress in order to prevent damage and introduction of foreign matter.

1.1.36 Sleeves

Wherever piping passes through walls, floors, ceilings, etc. sleeves shall be used, unless otherwise specifically called for. Sleeves shall be large enough to accommodate the full thickness insulation of insulated lines as well as to allow for any lateral movement due to expansion of lines. Sleeves shall be flush with walls, but shall project 100 mm above floors.

1.1.37 Pipe Support Installation

1.1.37.1 Aside from regular supports provide additional supports at or near changes in pipe direction, near heavy valves and other heavy appurtenances and at or near expansion joints.

1.1.37.2 Provide additional supports to eliminate pipe swaying and vibration.

1.2 Piping Standards

1.2.1 Pipe Sizes

➢ The following metric pipe sizes are equivalent:

Inches	mm	Inches	mm	Inches	mm
1/2	15	6	150	22	550
3/4	20	8	200	24	600
1	25	10	250	26	650
1-1/2	40	12	300	28	700
2	50	14	350	30	750
2-1/2	65	16	400	32	800
3	80	18	450	34	850
4	100	20	500	36	900

1.2.2 Abbreviations

➢ The following are abbreviations commonly used in engineering:

- ➢ ASME American Society for Mechanical Engineers
- ➢ ASTM American Society for Testing of Materials
- ➢ AWWA American Water Works Association
- ➢ ANSI American National Standards Institute
- ➢ BE Bevelled Ends
- ➢ BS Bell and Spigot
- ➢ BF Butterfly Valve
- ➢ BV Ball Valve
- ➢ BW Buttweld
- ➢ CSA Canadian Standards Association
- ➢ CUA Canadian Underwriters Association
- ➢ CAF Compressed Asbestos Fibre
- ➢ CS Carbon Steel
- ➢ CK Check Valve

➢ DP	Diaphragm Valve
➢ ERW	Electric Resistance Weld
➢ FF	Flat Face
➢ FM	Factory Mutual
➢ FS	Forged Steel
➢ Galv	Galvanized
➢ GA	Gate Valve
➢ GJ	Ground Joint
➢ GL	Globe Valve
➢ IS	Integral Seat
➢ kPa	kiloPascal
➢ MI	Malleable Iron
➢ MJ	Mechanical Joint
➢ NV	Needle Valve
➢ NRS	Non-rising Steam
➢ OS&Y	Outside Screw & Yoke
➢ PE	Plain Ends
➢ PI	Pinch Valve
➢ PSIG	Pounds per Square Inch Gauge
➢ PV	Plug Valve
➢ RF	Raised Face
➢ RS	Rising Steam
➢ SO	Slip ON
➢ SOFF	Slip On-Flat Face
➢ SORF	Slip On-Raised Face
➢ SE	Screwed Ends
➢ SMLS	Seamless
➢ SJ	Solder Joints
➢ SCWD	Screwed
➢ SW	Socket Weld
➢ SCH	Schedule
➢ STR	Strainer
➢ THK	Thickness
➢ WN	Weld Neck
➢ WNRF	Weld Neck-Raised Face
➢ WNFF	Weld Neck-Flat Face

2. TESTING - GENERAL

2.1 Pressure tests shall be made in accordance with the piping specification on all piping included in this Contract and in accordance with ASME B31.3. All pumps, gauges, other equipment and material necessary for the tests shall be furnished by the Contractor. All tests shall be made in the presence of the Engineer.

2.2 Tests of piping systems where local government regulations apply shall be witnessed by the appropriate official and a certificate of approval shall be furnished to the Engineer.

2.3 The Contractor shall notify the Engineer and government officials, when applicable, when any work is completed and ready for inspection and final test. On the satisfactory completion and final test of a completed system, a certificate of approval, signed by the witnessing parties, shall be issued to the Owner.

2.4 The following items shall be isolated from the system during the test:

- Expansion joints;
- Safety and relief valves (except those used to relieve thermal expansion of the testing (fluid);
- Instruments;
- Control valves;
- Connected equipment.

2.5 Before testing, all lines shall be thoroughly cleaned internally and flushed, where water is permissible, or blown out in accordance with the Piping Specification. Temporary strainers shall be installed between flanges prior to blowing or flushing out of systems in order to protect equipment downstream of the temporary strainers.

2.6 Underground lines shall be tested before covering joints.

2.7 Piping shall be tested prior to insulating. Where factory insulated pipe is used, joints shall not be insulated until after testing.

2.8 The maximum permissible seat pressure for iron body valves and butterfly valves shall be the maximum cold working pressure of the valve. Where this is less than the test pressure of the piping system, these valves shall be open during test.

2.9 Where blanks are used to isolate piping or equipment items, the blanks shall be of the thickness required for the pressure class as shown in ASME B31.3.

2.10 Where a short section must be removed from a line in order to apply a test, these pieces shall be tested separately.

2.11 When conditions require that a pressure test be maintained for a period of time during which the testing medium in the systems would be subject to thermal expansion, provision shall be made for relief of excess pressure.

2.12 Care shall be exercised when testing large lines and equipment such that supporting structures will not be overloaded.

2.13 Lines that are spring or counterweight supported shall be blocked up during test in order to sustain the hydrostatic load; such temporary blocking to be removed upon completion of test.

2.14 Vents shall be located at highest points and shall be opened to assure complete displacement of the air from the system. After the system is thoroughly purged of air, the vents shall be closed and the test pressure applied.

2.15 Test pressure reading may be taken at the lowest point of the line or system of lines being tested.

2.16 The temperature of the test fluid shall not exceed 51.7°C (125°F).

2.17 Lines containing check valves shall have the source of pressure located on the upstream side of the valve so that the pressure is applied under the seat. These valves shall be locked in open position and unlocked after completion of the test.

2.18 After repairs by welding, lines so repaired shall be retested at pressures originally specified for the test. Any leaks or defects that are disclosed by tests shall be remedied and made good and tested again by the Contractor at his own expense. Shop welded sections shall be tested individually in accordance with this specification.

2.19 Any leaks found on screwed joints and connections shall be disassembled and refitted and test repeated until the results are satisfactory. No caulking or other compounds shall be applied to the joint that leaks to remedy the leak.

2.20 After satisfactory completion of testing:

- ➢ All lines shall be completely drained;
- ➢ All temporary blanks, plugs, strainers, valves and nipples shall be removed;
- ➢ Safety valves, relief valves and piping which have been removed shall be installed with proper gaskets in place.
- ➢ Threaded openings used during the testing procedure and for which there is no use shall be plugged in accordance with the piping materials specification;
- ➢ Insulation and painting shall then be completed;
- ➢ Orifice plates shall be installed after the pipeline has been tested.

2.21 Exposed piping shall be left clean and free from oil, grease, thread lubricant, solder, lead, etc.

2.22 Tests of piping systems falling under the jurisdiction of Authorities shall be witnessed by these Authorities. The Contractor shall advise the Authorities of the time of the tests and shall obtain the appropriate certificates of inspection and tests.

2.23 Where the specified test procedures differ from those set out by the Authorities. The more stringent procedure of the two shall be followed.

2.24 Do not install orifice plates until after tests are completed. Remove or blank off from lines during testing all rupture discs and relief valves.

2.25 Do not pressure test against close butterfly valves. Provide blind flanges or insert blinds.

2.26 Maintain hydrostatic test pressures for minimum period specified. Carefully inspect all joints for leaks. Maintain pneumatic test pressure for such length of time as may be required to soap and examine all joints.

2.27 Replace cracked or burst piping and components entirely.

2.28 All piping to be cleaned thoroughly after tests, by flushing and blowing with compressed air. For cleaning oxygen services refer to the Pipe Specification. For lines with screwed joints add detergents while flushing in order to remove excess pipe dope, etc. Do not use detergents injurious to piping and components.

2.29 After piping has been tested and cleaned and related equipment has been check-out, operate systems to demonstrate that there are no obstructions, short circuits or wrong connections and that systems have been installed properly, are adjusted properly and can perform the intended functions.

2.30 Check for flow in all circuits, adjust valve settings, adjust controls, adjust flows to design values.

2.31 Exercise and/or lubricate plug valves at regular intervals to prevent them from "freezing" if piping systems are not put into service for any appreciable period of time after completion.

2.32 Keep complete and accurate record of the following events:

- ➢ Testing and retesting;
- ➢ Cleaning (flushing, sterilizing, etc.);
- ➢ Checking-out;
- ➢ Adjusting (flows, pressure, etc.).

2.33 Keep records of event details and results. Record times and dates. Sign records and have them countersigned by the Owner's and/or Engineer's representatives witnessing the events. Compile records per system. Make copies available to the Owner and/or Engineer.

3. WELDING

3.1 Welding Standards

3.1.1 The welding of pipe shall conform to the requirements of ANSI B31.3, Process Piping Code.

3.1.2 For pipe supports, Structural Steel Welding Code CSA W59, shall apply.

3.1.3 Welders for piping shall be qualified in accordance with ASME Boiler and Pressure Code, section IX and in accordance with the local governing codes and regulations. Use approved welding procedures only. Stamp welder's identification mark on a

built-up portion of each pipe joint. Submit sample welds for inspection if so requested by the Engineer.

3.2 Welding Inspection

3.2.1 Provide continual access for inspection of the work to the Engineer. No weld shall be covered and no insulation applied before the inspection has been carried out.

3.2.2 One or more of the following defects shall because for rejecting of a weld:

- ➢ Failure to meet x-ray requirements or other code test;
- ➢ Welding performed by unqualified person;
- ➢ Welds not reasonably uniform in appearance;
- ➢ Evidence of peening;
- ➢ Cracks, pinholes;
- ➢ Oxidation around welds;
- ➢ Lack of fusion and/or incomplete penetration;
- ➢ Presence of porosity, slag inclusion or overlaps;
- ➢ Undercutting adjacent to completed welds or evidence of undercutting by grinding;
- ➢ Any other fault at the discretion of the x-ray specialist.

3.2.3 Joints in welded piping systems shall be x-rayed by a firm specialized in this field, approved by the Engineer and employed at the Contractor's expense. X-rays shall be interpreted by the same firm and/or by the Owner. The x-rays shall be the full circumferences of the weld. The number of welds to be x-rayed shall comply with ASME B31.3.

3.2.4 The Owner reserves the right to request the x-raying of any welded joint and will bear the cost of this if the joint is sound. However, the cost of x-raying and repair of joint shall be borne by the Contractor for any defective joints.

3.2.5 The x-raying company will decide on the soundness of the welds and the type of repair required and their decision will be binding on the Contractor. Cost of the final x-ray of the joint shall also be at the Contractor's expense.

3.2.6 The films shall be marked with date and location of welds. Poor films may be rejected and replacement called for at the Contractor's expense.

3.2.7 If more than 5% of the total number of welds x-rayed fail to meet the requirements, extend the x-ray tests to include all welds at Contractor's expense. All the work which shall be redone because of rejected welds shall be at the Contractor's expense.

4. PIPING EQUIPMENT INSTALLATION

4.1 Type of Work Covered

4.1.1 This section is intended to cover the installation, pre-operating check-out, start-up, testing and adjusting of mechanical equipment (such as pumps, compressors, strainers, vessels, hydraulic power units and reservoirs, etc.) related to piping and mechanical service systems.

4.1.2 This specification is not intended to cover process equipment proper such as furnaces, casters, etc. nor materials handling equipment.

4.2 Inspection Prior to Installation

4.2.1 Check to see whether covers of openings on equipment are in place and are not damaged. Report condition to the Engineer, particularly report missing or damaged covers.

4.2.2 Remove covers and inspect accessible internal areas. Report to Engineer condition of internal areas, particularly report any damage, foreign matter, fouling and/or rusting. Clean, repaint and/or recoat as required. Replace protective covers properly.

4.2.3 Rotate shafts of such equipment as pumps, motors, etc.

4.2.4 Remove covers of bearings and inspect for accumulation of moisture, rust and foreign matter. If equipment has lubricant or preservative in it check for contamination. Report condition to Engineer. Clean bearings and bearing housings as required and refill with lubricant or fill with flushing oil. Reinstall and secure bearing and other covers.

4.2.5 In cases of fouling of internals and of bearings the manufacturer may request further inspection, further dismantling, the replacement of parts and/or special restoration procedures.

4.3 Protection During Construction

4.3.1 Protect equipment during the whole construction period. The contractor shall thoroughly familiarize himself with any special protection requirements and procedures.

4.3.2 Periodically check that all access covers are firmly in place and the internal areas remain free of contamination. If equipment piping remains unconnected then also check that nozzle and flange covers are tightly in place and remain undamaged.

4.3.3 Periodically rotate shafts of such equipment as pumps, motors, etc.

4.4 Plumbs and Lines

Install equipment plumb and level and true to lines.

4.5 Assembly of Equipment

Assemble equipment that arrives on site knocked-down. Make sure that match marked parts mate properly. Report any misfit to the Engineer.

4.6 Anchor Bolts

Before setting equipment down in place check that anchor bolts are properly located, are of the proper length, etc. Advise the Engineer of any problems. DO NOT cut off or bend any anchor bolts without prior approval.

4.7 Excessive Length of Anchor Bolts

Where anchor bolts require shortening, use methods that do not damage threads. Run threading die over cut-off bolts to make sure. The anchor bolts shall not project above the nut more than half the bolt diameter.

4.8 Other Hold-Down Devices

Where set-in concrete anchor bolts have not been provided, "Expansion Anchors" or similar devices may be used. The use of such devices for fastening vibrating machinery shall be prohibited unless specifically approved by the Engineer.

4.9 Foundations

Before setting equipment down, check that the foundation is at the proper height to accommodate the required thickness of grout. Lower by chipping if necessary. Also ensure that concrete surfaces are clean and are free of oil and grease.

4.10 Positioning of Equipment

Wedges and jacks may be used in order to position equipment. However, the Contractor shall ensure that such devices do not distort and/or damage the equipment and machinery.

4.11 Shear Blocks

Where necessary to overcome high lateral forces, the Contractor may have to provide shear keys/shear blocks as called for on the drawings and as necessary.

4.12 Grouting

4.12.1 The Contractor shall check that wedges have been removed, that hold-down bolts have been tightened and double-check equipment location, elevation and alignment.

4.12.2 Immediately before grouting, the Contractor shall thoroughly clean the space between the concrete and the equipment base and make sure it is free from oil, grease and excessive moisture. Grout material to be non-shrinking.

4.13 Motor Rotation

Prior to connecting motors to the equipment the motors shall first be turned over by hand. Then the motors shall be "bumped" in order to see that they rotate in the proper direction.

4.14 Drive Alignment

Drives shall be assembled and installed in strict accordance with manufacturer's instructions and within manufacturer's tolerances.

4.15 Access for Maintenance

All drives and power transmission equipment shall be installed so that it can be maintained. Where grating, floor plates or similar structures interfere with maintenance access, the Contractor shall immediately bring the matter to the Engineer's attention so that a satisfactory solution can be approved.

4.16 Belt Drives

The Contractor shall ascertain that belts in any given drive are matched and that belts are evenly and properly tensioned to manufacturer's tolerances.

4.17 Drive Guards

The Contractor shall ascertain before operation that drive guards are in place and are adequate. Repair any damaged guards and provide guards where they are required but have not been supplied with equipment.

4.18 Temporary Strainers

Where permanent strainers are not installed immediately upstream of pumps, compressors, etc., the Contractor shall provide temporary strainers.

4.19 Drains

Neatly pipe to nearby drains the drains from equipment pans, bases, glands, etc.

4.20 Lubrication

All the lubrication work shall be done in accordance with the requirements of the equipment manufacturer.

4.21 Check-Out by Manufacturer

Before operating the equipment, the Contractor shall have the equipment checked out by the manufacturer's representative, except where such service is not available from the manufacturer or is traditionally not provided by the manufacturer. In these cases, the Contractor shall undertake a pre-operation checkout himself.

4.22 Turning Equipment by Hand

Before operating with power, equipment such as pumps, etc., equipment shall be turned over by hand in order to ascertain that it is free to rotate.

4.23 Pre-Operation Check-out

Follow the manufacturer's installation and operation manuals. In addition to the special requirements set out for any given piece of equipment by the manufacturer, the requirements of this section shall be respected.

4.24 Running-in Period

4.24.1 As far as practical, the equipment shall at first be operated under no load or with reduced load. Operate the equipment continuously until all bearings have reached steady temperatures. Whenever practical, bring equipment to full load conditions gradually.

4.24.2 Adjust stuffing boxes, glands and seals.

4.24.3 Put equipment, controls and instrumentation through complete cycles of operation.

4.24.4 Ascertain that equipment is capable of its intended functions over the full operating range, that machinery is capable of intended speed, that there are no excessive vibrations, etc.

4.24.5 Keep the Engineer informed of progress, particularly report problems. Make adjustments, repairs and take remedial actions with manufacturer's advice and/or assistance as applicable and as approved.

4.24.6 Keep records as the work progresses.

4.25 Performance Demonstration

After the running-in period and after all necessary adjustments are made, the Contractor shall demonstrate to the Engineer and/or Owner that the equipment is fully operational and ready for acceptance by the Owner.

4.26 Cleaning

Remove protective coating and clean equipment in accordance with manufacturer's instructions. Do not use solvents, cleaners and cleaning methods that may damage paint, permanent coating and machinery finishes.

4.27 Keeping of Records

4.27.1 Keep complete and accurate records of at least the following:

- ➢ Inspection prior to installation.
- ➢ Inspection/protection during construction.
- ➢ Alignment of drives.
- ➢ Lubrication.
- ➢ Bumping of motors.
- ➢ Pre-operational checkout.
- ➢ Running-in adjustments.
- ➢ Performance demonstration.

4.27.2 Keep records of event details and results. Record times and dates. Sign records and have them counter-signed by the manufacturer representative (where applicable) and the Owner's and/or Engineer's representative witnessing the events. Compile records per equipment and per system. Make copies available to the Owner and/or the Engineer.

END OF SECTION

1. PIPE SUPPORTS, HANGERS, GUIDES AND ANCHORS

1.1 All pipes to be supported in accordance with this standard unless otherwise stipulated.

1.2 All piping shall be substantially supported with the necessary hangers, structural supports, brackets, etc. as required. The support and bracing of piping shall be such as to prevent sagging, warping and vibration and shall allow for movement due to expansion and contraction. Hangers and supports shall be placed next to fittings, valves and other heavy parts.

1.3 Spring hangers shall be used to support piping systems to accommodate vertical movements where required.

1.4 Pipe hangers or supports for pipes of dissimilar material shall be isolated.

1.5 All vertical piping shall be supported by clamp type hangers. Supports for hangers shall be secured to masonry with expansion bolts and to steel structures with machine bolts or welding, (when approved by the Engineer). Vertical support shall be spaced not more than 1.5 times the maximum span specified for horizontal pipes as indicated.

1.6 Hanger and support spacing, unless otherwise specified, shall be in accordance with ANSI B31.1 - Code for Power Piping (latest edition).

1.7 Where pipe sloping is required, the supports, anchors and guides shall be carefully set to grades and lines such that the finished installation will provide uniform continued slope for drainage as indicated on the drawings.

1.8 Expansion shall be directed so as to minimize stresses in the pipe and equipment connections.

1.9 Where pipes are grouped, support spacing must satisfy smallest pipe.

1.10 Anchors shall be constructed of steel frames or straps welded to the pipe and firmly attached to the building or suitable structure in a manner approved by the Engineer. The steel shall be of a grade similar to the pipe to which it is attached.

1.11 The Contractor shall install guides or braces as required to control movement of the piping, to hold the pipe in proper alignment and resist the forces of water hammer and vibration.

1.12 Guides shall be firmly attached to the supporting structures.

1.13 Bell and spigot pressure pipes, mechanical-joint pipe and concrete pressure pipe joints shall be anchored at all bends, tees or plugged ends, by means of poured concrete anchors, or clamps and tie-rods as specified on the drawings. Tie-rods shall be installed at intermediate joints of bell and spigot pressure pipe where required to prevent buckling. Clamps and tie-rods and nuts shall be galvanized above ground or coated with asphalt below ground.

1.14 Protection saddles, or structural supports shall be installed for protecting the insulation at pipe supports and guides.

1.15 All figure numbers are from the ITT Grinnell Corporation catalogue but approved equivalent of other manufacturers may be used.

1.16 All support sizes, maximum loads and limitations to be in accordance with manufacturer's recommendations.

1.17 All "U" bolts shown in the following standards, except on guides and anchors, should grip the pipe only and not be overtightened. Care to be taken on plastic pipes.

1.18 All pipes 50 (2 inches) and smaller are to be field supported unless pipes are part of a gang.

1.19 The attachment of pipe supporting assemblies must not weaken or damage any structural members to which they are attached.

1.20 Welding is only acceptable to structural steel when approved by the Engineer, or where the steel is provided solely for pipe support duty.

1.21 Bolting to structural steel is only acceptable when approved by Engineer, or where the steel is provided solely for pipe support duty. Holes must be drilled and not burned.

1.22 Drilling of reinforced concrete surfaces for concrete fasteners shall be used only when no other method of attachment is available i.e support steel or inserts embedded into poured concrete.

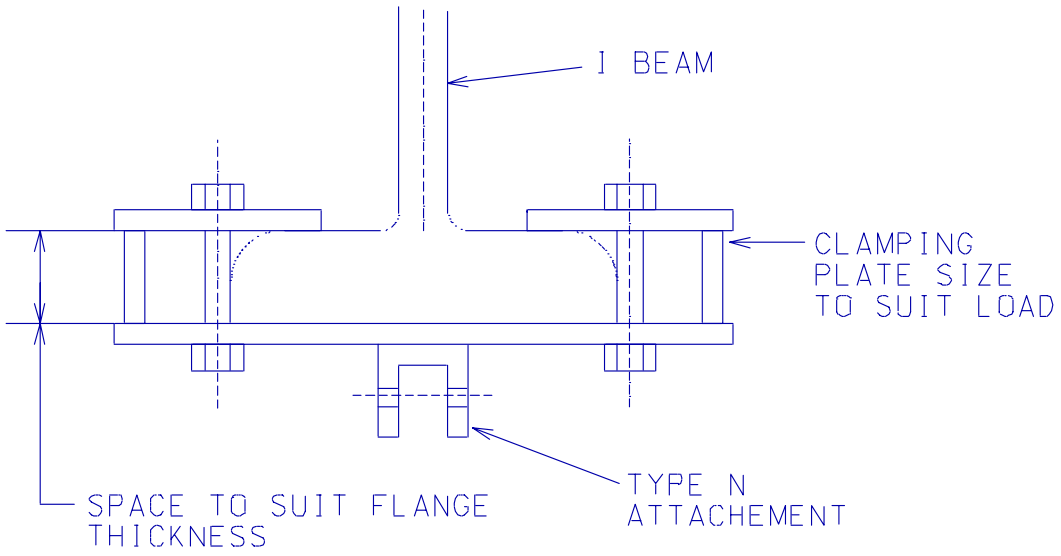
1.23 Acceptable methods of attachment include:

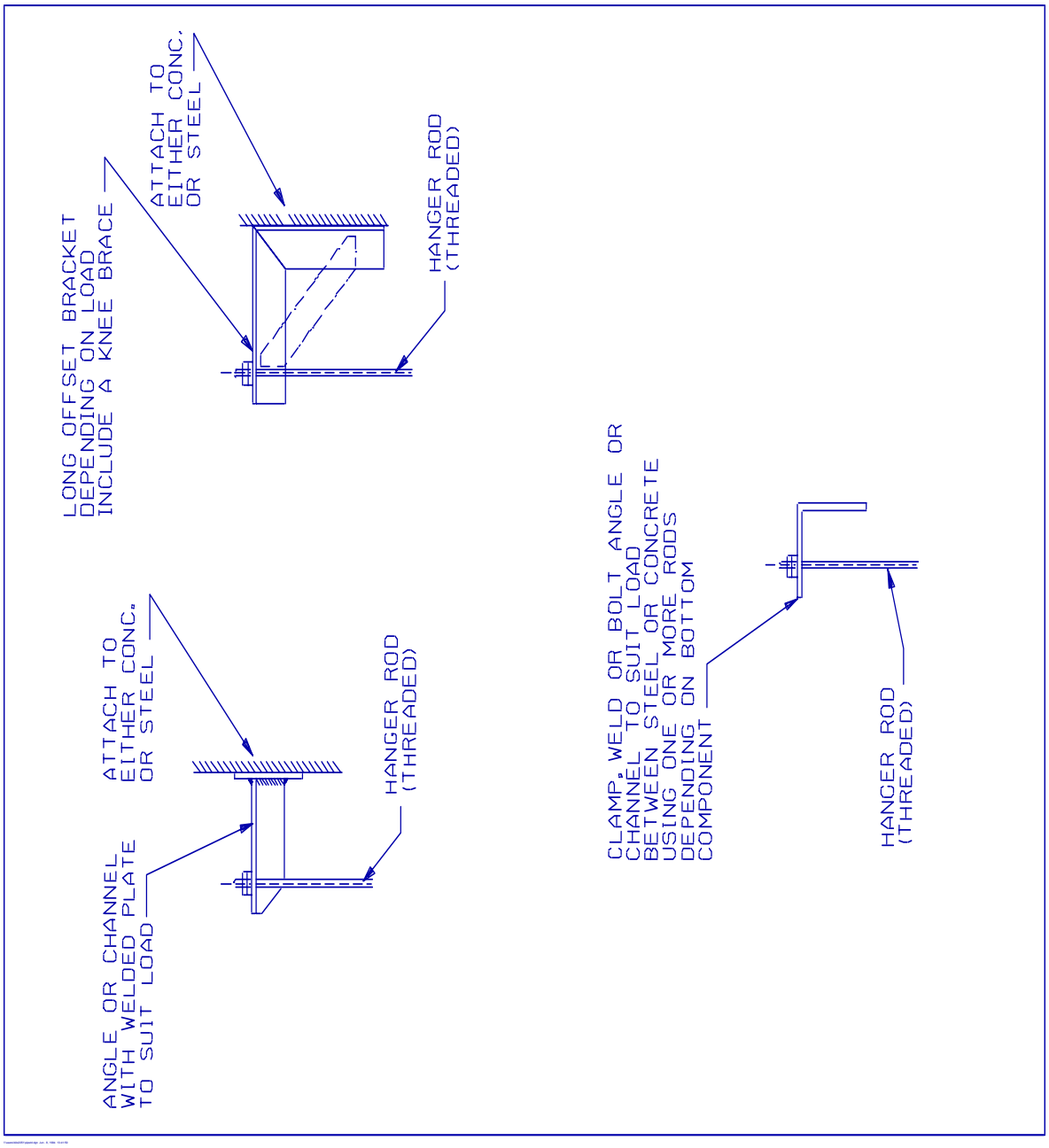
- ➢ Clamping to structural members.
- ➢ Bolting to structural members when approved (see prior note).
- ➢ Welding to structural members provided solely for pipe support.
- ➢ Welding to non-structural steel plate which are clamped or bolted to structural members.

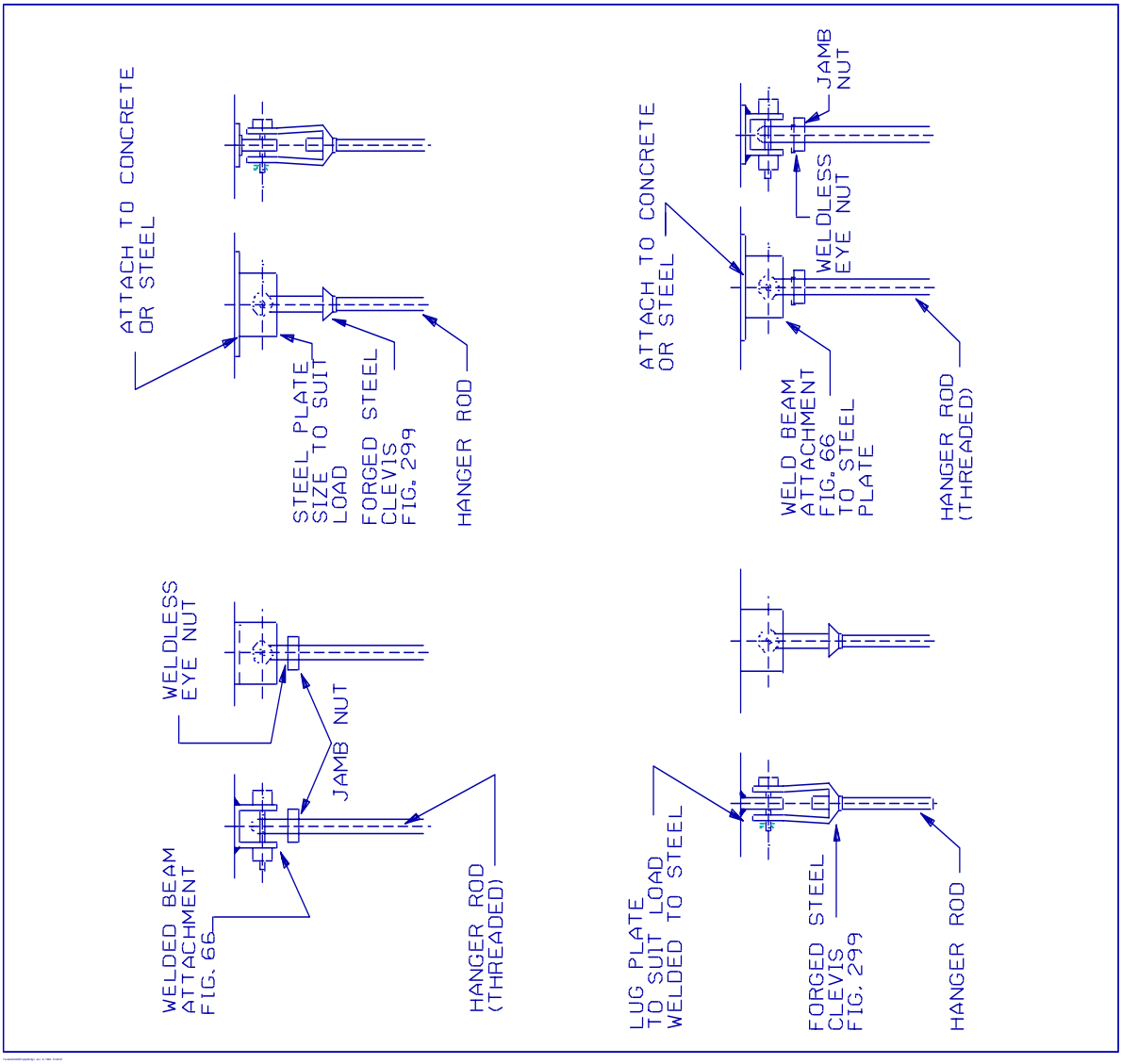
- ➢ Welding to non-structural steel plates embedded in poured concrete.
- ➢ Threaded rods screwed into malleable inserts embedded in poured concrete.

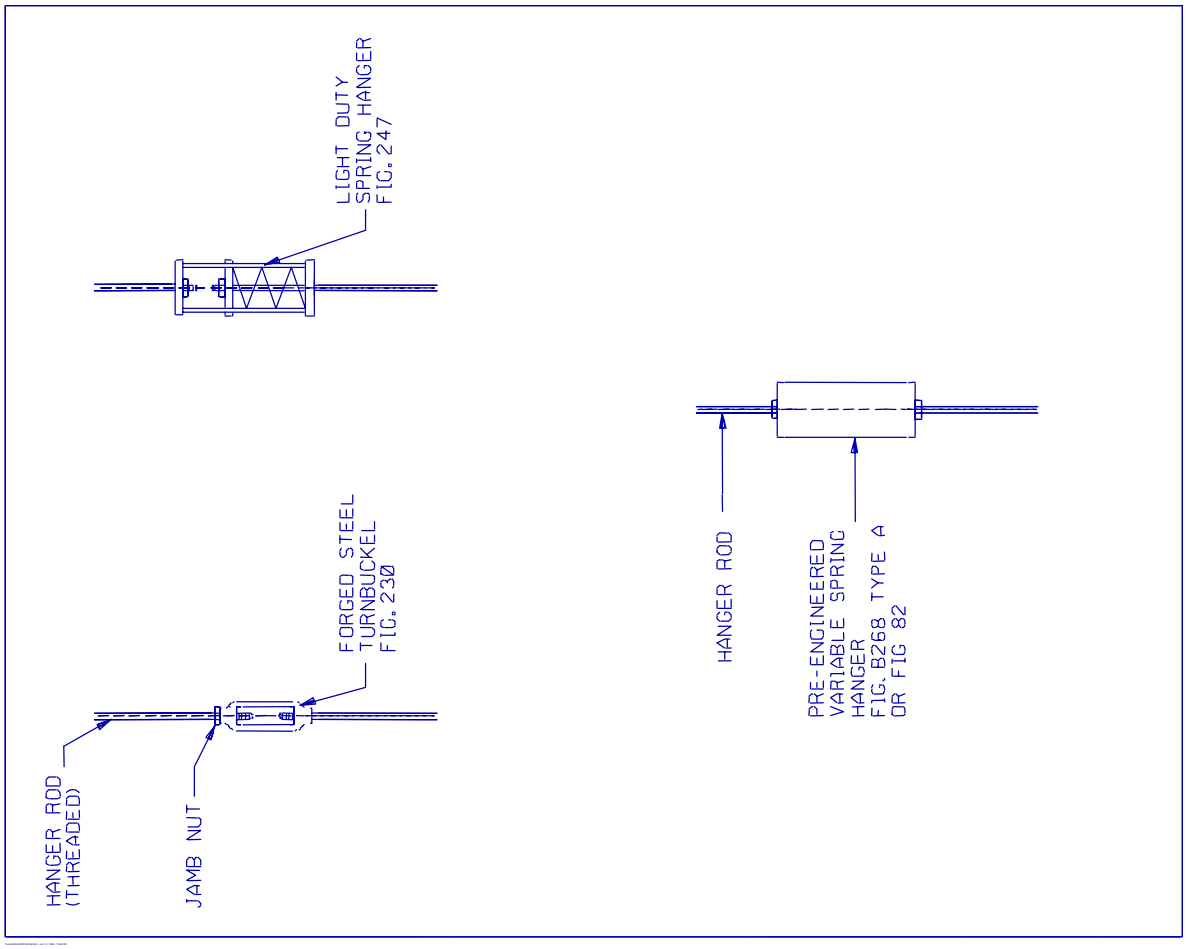
1.24 Attachment of clamping plates to standard steel sections can be achieved by using "Lindapter" bolt adaptors and clamping plate. See Lindapter catalogue or information sheets supplied by the manufacturer.

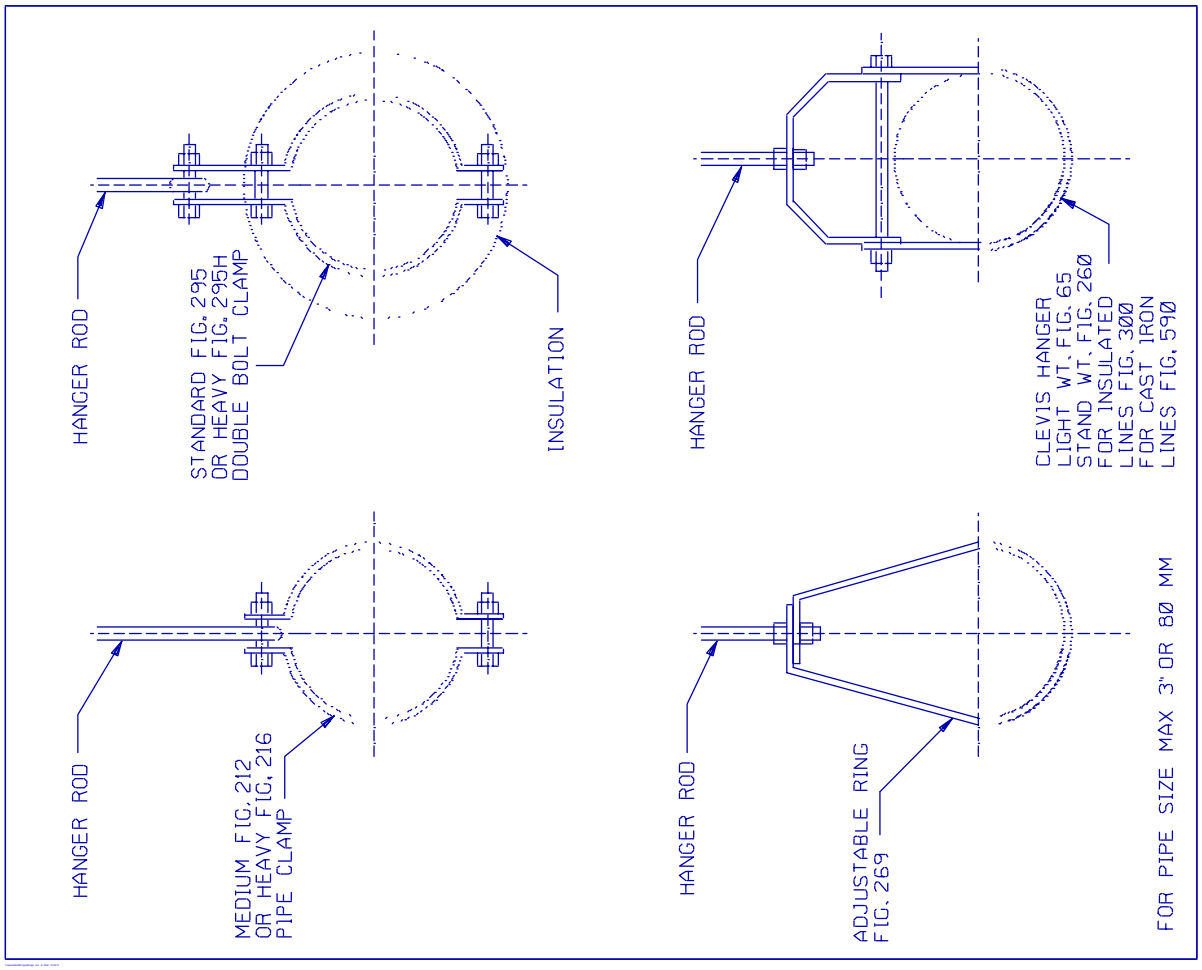
1.25 Methods of attaching clamping plates to fabricated steel section to be similar to typical detail shown below:

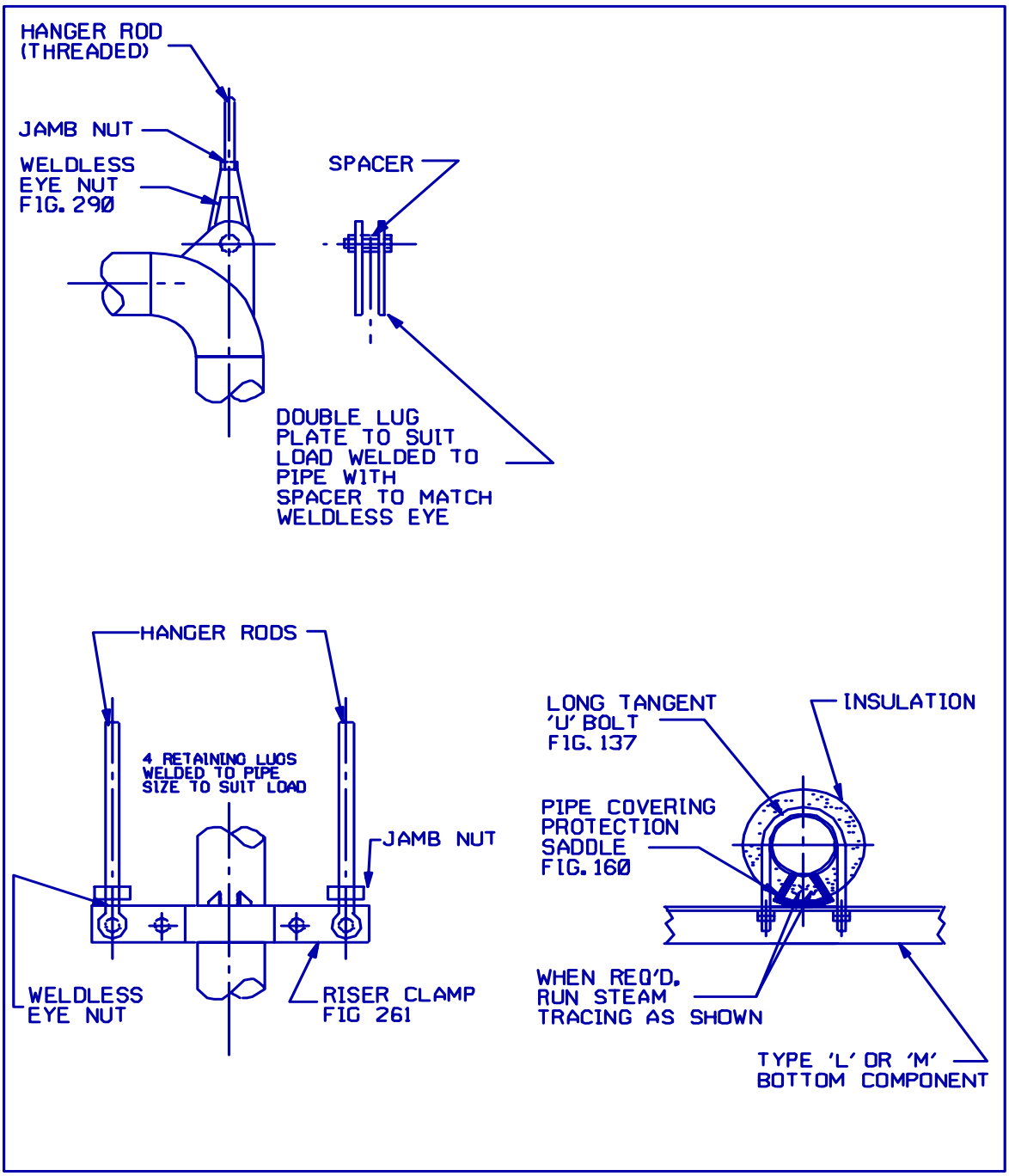


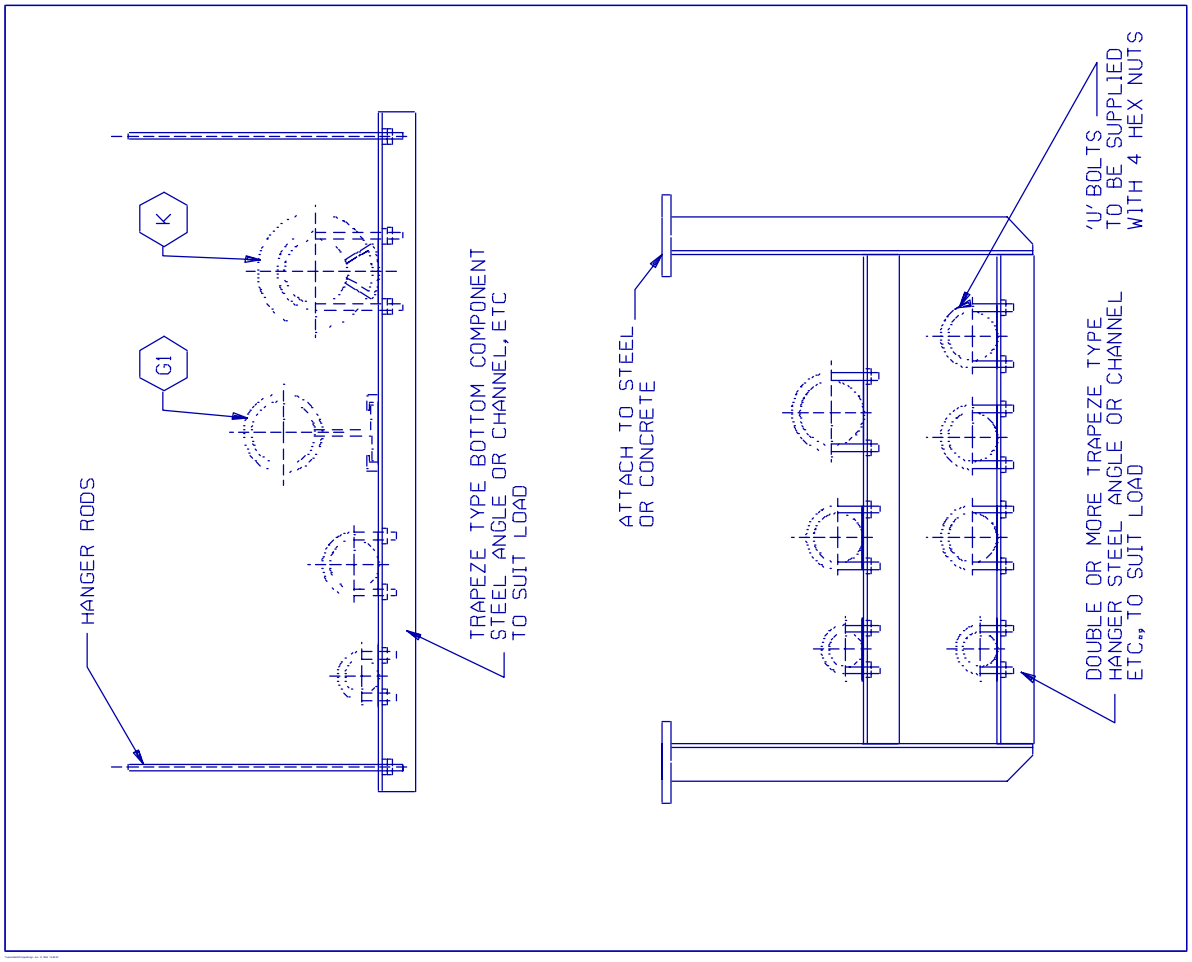

LONG OFFSET BRACKET DEPENDING ON LOAD INCLUDE A KNEE BRACE
ATTACH TO EITHER CONC. OR STEEL
HANGER ROD (THREADED)
ATTACH TO EITHER CONC. OR STEEL
HANGER ROD (THREADED)
ANGLE OR CHANNEL WITH WELDED PLATE TO SUIT LOAD
CLAMP, WELD OR BOLT ANGLE OR CHANNEL TO SUIT LOAD BETWEEN STEEL OR CONCRETE USING ONE OR MORE RODS DEPENDING ON BOTTOM COMPONENT
HANGER ROD (THREADED)

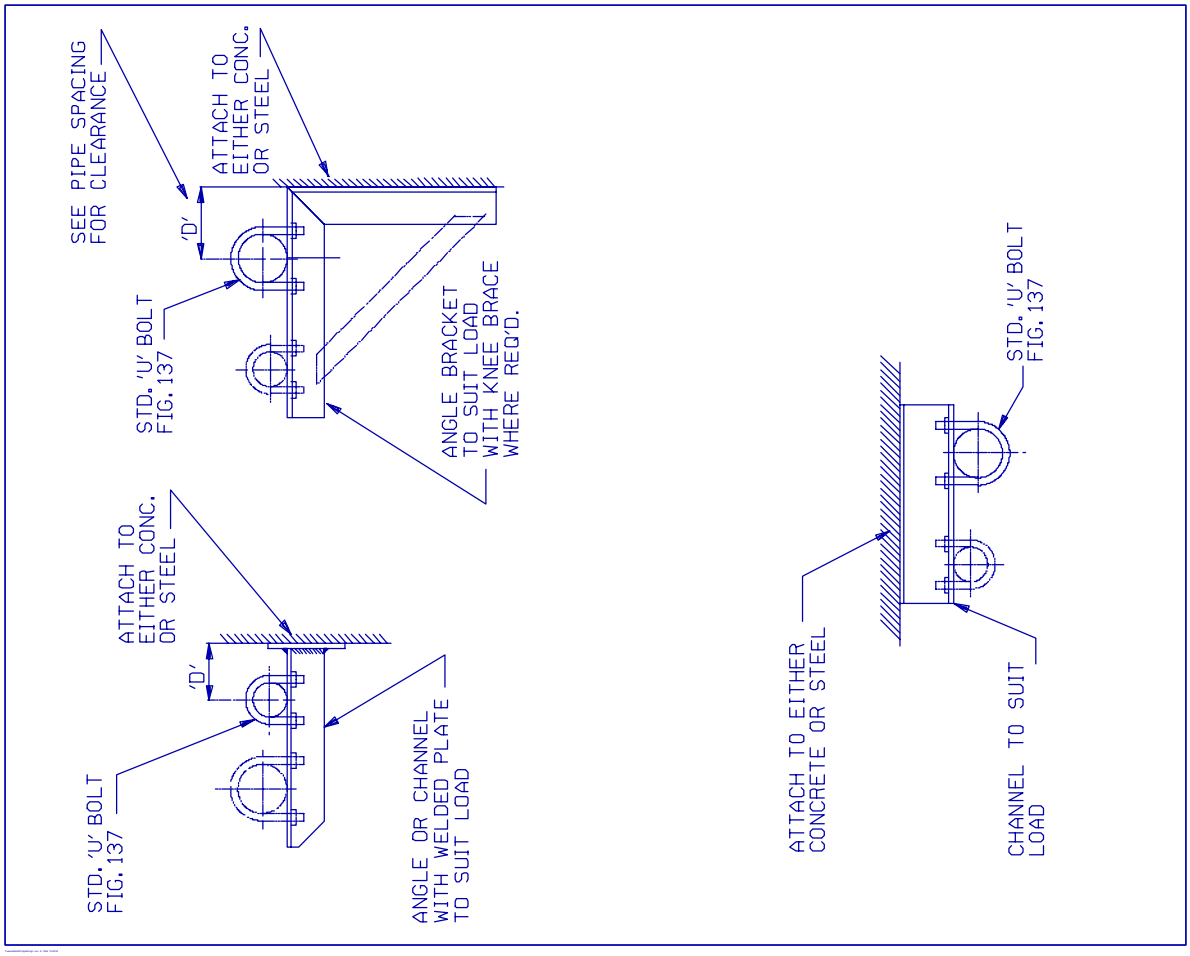

ATTACH TO CONCRETE OR STEEL
STEEL PLATE SIZE TO SUIT LOAD
FORGED STEEL CLEVIS FIG. 299
HANGER ROD
ATTACH TO CONCRETE OR STEEL
JAMB NUT
WELDLESS EYE NUT
WELD BEAM ATTACHMENT FIG. 66 TO STEEL PLATE
HANGER ROD (THREADED)
WELDLESS EYE NUT
JAMB NUT
WELDED BEAM ATTACHMENT FIG. 66
HANGER ROD (THREADED)
LUG PLATE TO SUIT LOAD WELDED TO STEEL
FORGED STEEL CLEVIS FIG. 299
HANGER ROD

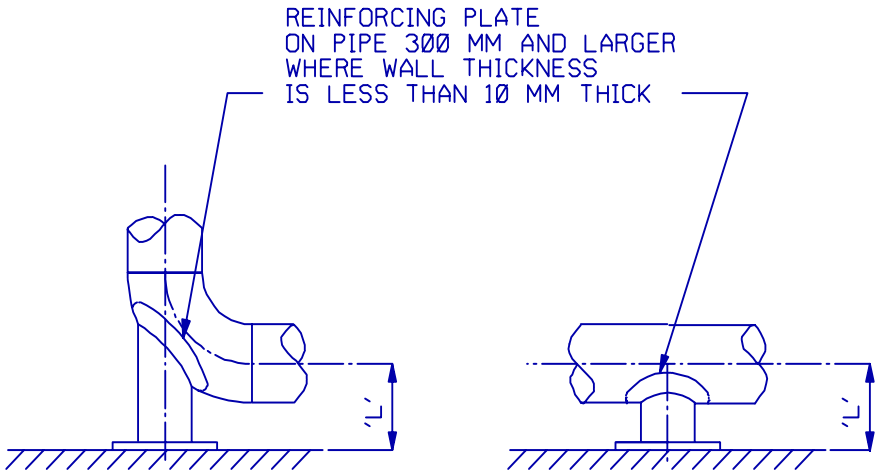

LIGHT DUTY
SPRING HANGER
FIG. 247
FORGED STEEL
TURNBUCKEL
FIG. 230
HANGER ROD
(THREADED)
JAMB NUT
HANGER ROD
PRE-ENGINEERED
VARIABLE SPRING
HANGER
FIG. B268 TYPE A
OR FIG 82


HANGER ROD
STANDARD FIG. 295
OR HEAVY FIG. 295H
DOUBLE BOLT CLAMP
INSULATION
HANGER ROD
CLEVIS HANGER
LIGHT WT. FIG. 65
STAND WT. FIG. 260
FOR INSULATED
LINES FIG. 300
FOR CAST IRON
LINES FIG. 590
HANGER ROD
MEDIUM FIG. 212
OR HEAVY FIG. 216
PIPE CLAMP
HANGER ROD
ADJUSTABLE RING
FIG. 269
FOR PIPE SIZE MAX 3" OR 80 MM

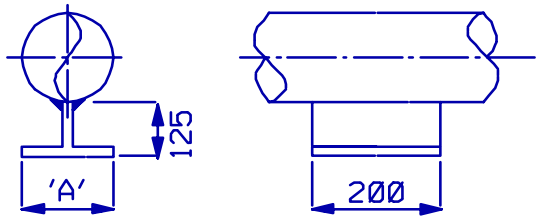

HANGER ROD (THREADED)
JAMB NUT
WELDLESS EYE NUT FIG. 290
SPACER
DOUBLE LUG PLATE TO SUIT LOAD WELDED TO PIPE WITH SPACER TO MATCH WELDLESS EYE
HANGER RODS
4 RETAINING LUGS WELDED TO PIPE SIZE TO SUIT LOAD
JAMB NUT
WELDLESS EYE NUT
RISER CLAMP FIG 261
LONG TANGENT 'U' BOLT FIG. 137
INSULATION
PIPE COVERING PROTECTION SADDLE FIG. 160
WHEN REQ'D. RUN STEAM TRACING AS SHOWN
TYPE 'L' OR 'M' BOTTOM COMPONENT


K
G1
HANGER RODS
TRAPEZE TYPE BOTTOM COMPONENT
STEEL ANGLE OR CHANNEL, ETC
TO SUIT LOAD
ATTACH TO STEEL
OR CONCRETE
'U' BOLTS
TO BE SUPPLIED
WITH 4 HEX NUTS
DOUBLE OR MORE TRAPEZE TYPE
HANGER STEEL ANGLE OR CHANNEL
ETC., TO SUIT LOAD

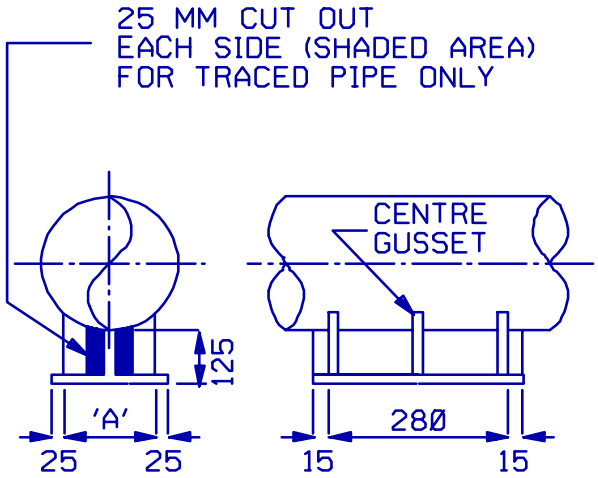

SEE PIPE SPACING FOR CLEARANCE
ATTACH TO EITHER CONC. OR STEEL
'D'
STD. 'U' BOLT FIG. 137
ANGLE BRACKET TO SUIT LOAD WITH KNEE BRACE WHERE REQ'D.
ATTACH TO EITHER CONC. OR STEEL
'D'
STD. 'U' BOLT FIG. 137
ANGLE OR CHANNEL WITH WELDED PLATE TO SUIT LOAD
STD. 'U' BOLT FIG. 137
ATTACH TO EITHER CONCRETE OR STEEL
CHANNEL TO SUIT LOAD



Main Pipe run size (in.)	**Main Pipe run size** (mm)	**Stanchion pipe size** (in)	**Stanchion pipe size** (mm)	**Max. lgth 'L'** (in)	**Max. lgth 'L'** (mm)	**Max. load** (lbs)	**Max. load** (kg)
For second pipe use tee & plugged dummy leg the same size as the pipe							
1 1/2 & 2	40 & 50			36	900		
3	80	2	50	36	900	800	363
4	100	2	50	72	1800	1200	544
6	150	4	100	72	1800	2500	1134
8	200	6	150	72	1800	3000	1360
10	250	6	150	72	1800	3800	1724
12	300	6	150	72	1800	4000	1814
14	350	8	200	120	3000	6000	2722
16	400	8	200	120	3000	6500	2948
18	450	TO BE CALCULATED					
20	500	TO BE CALCULATED					



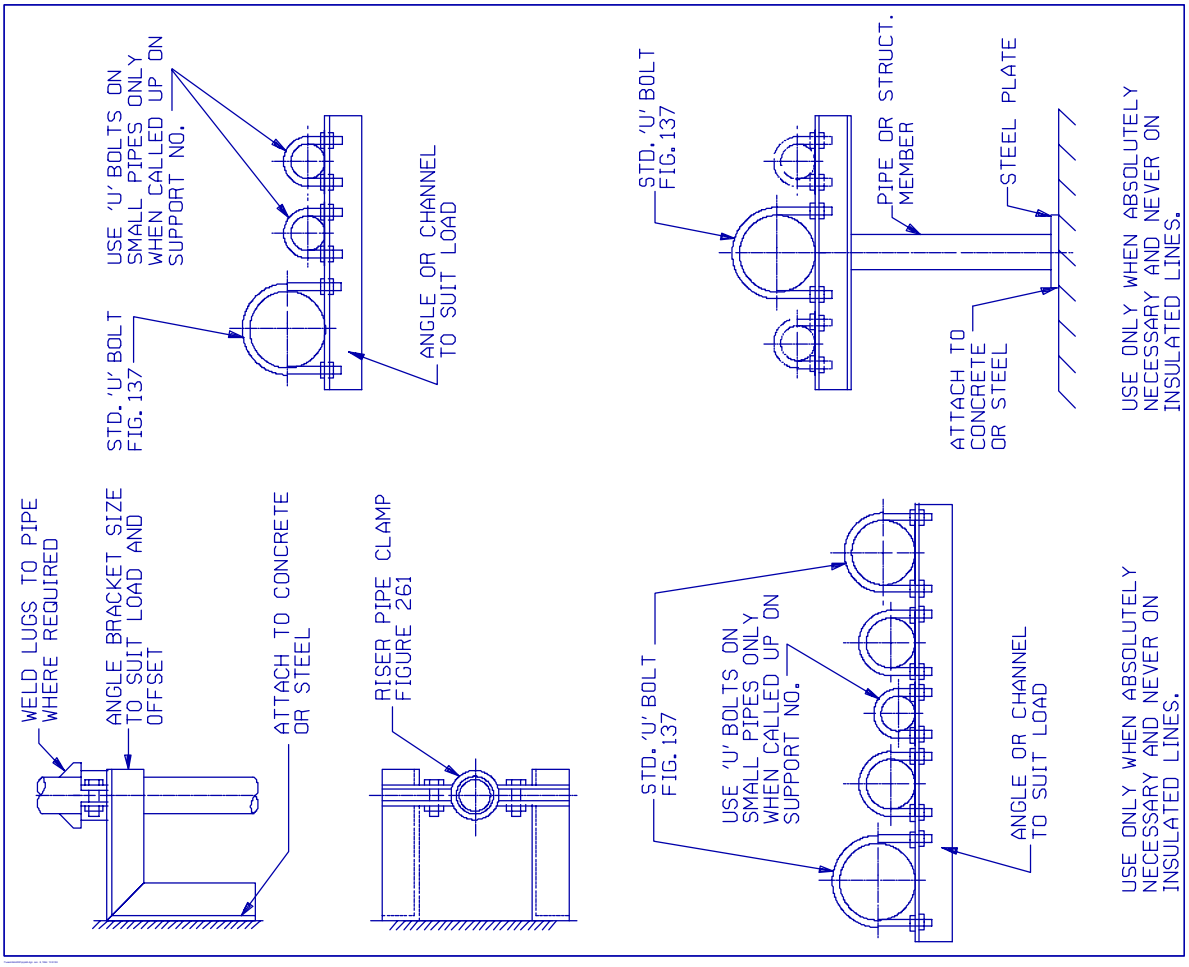
50 MM TO 200 MM PIPE

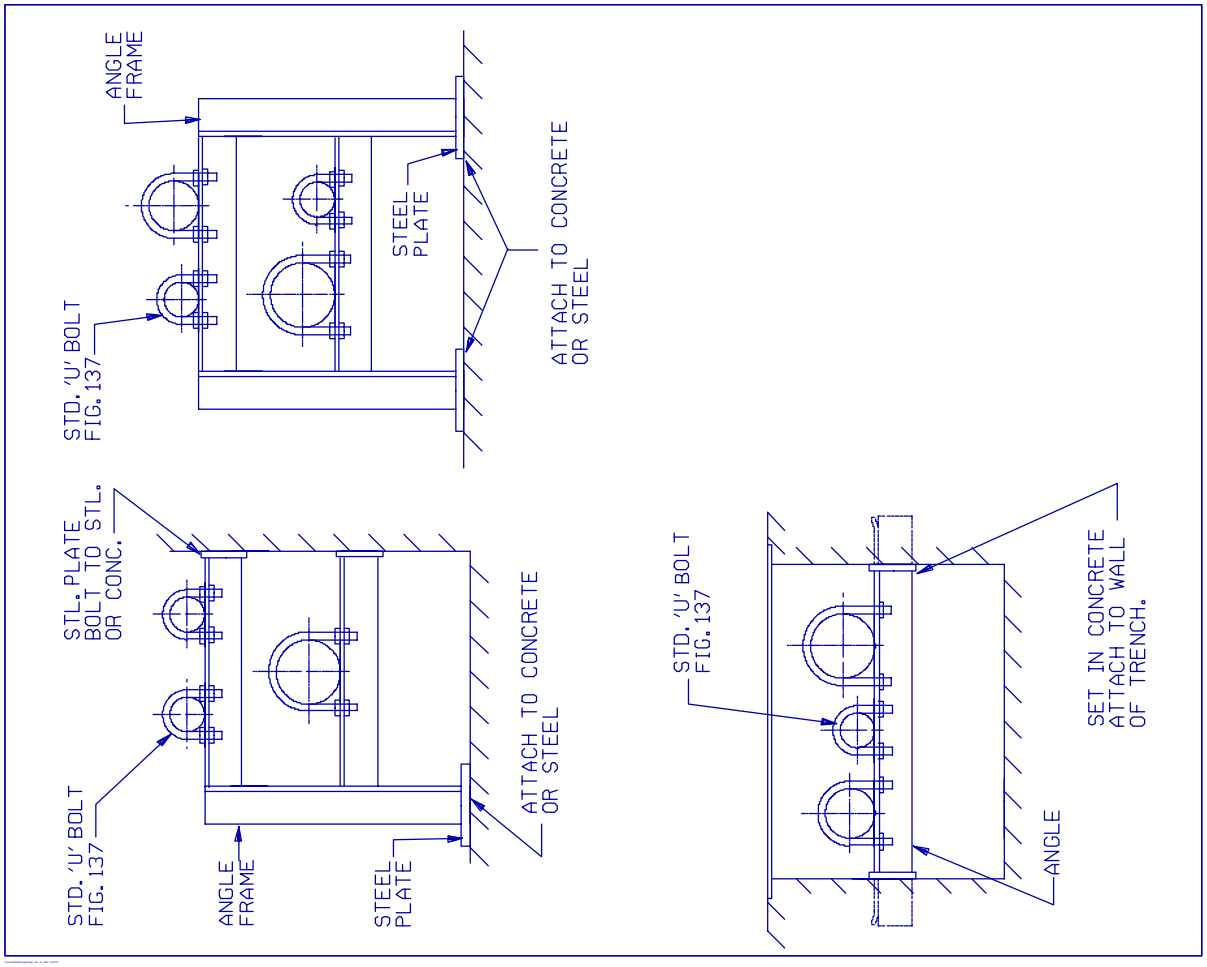


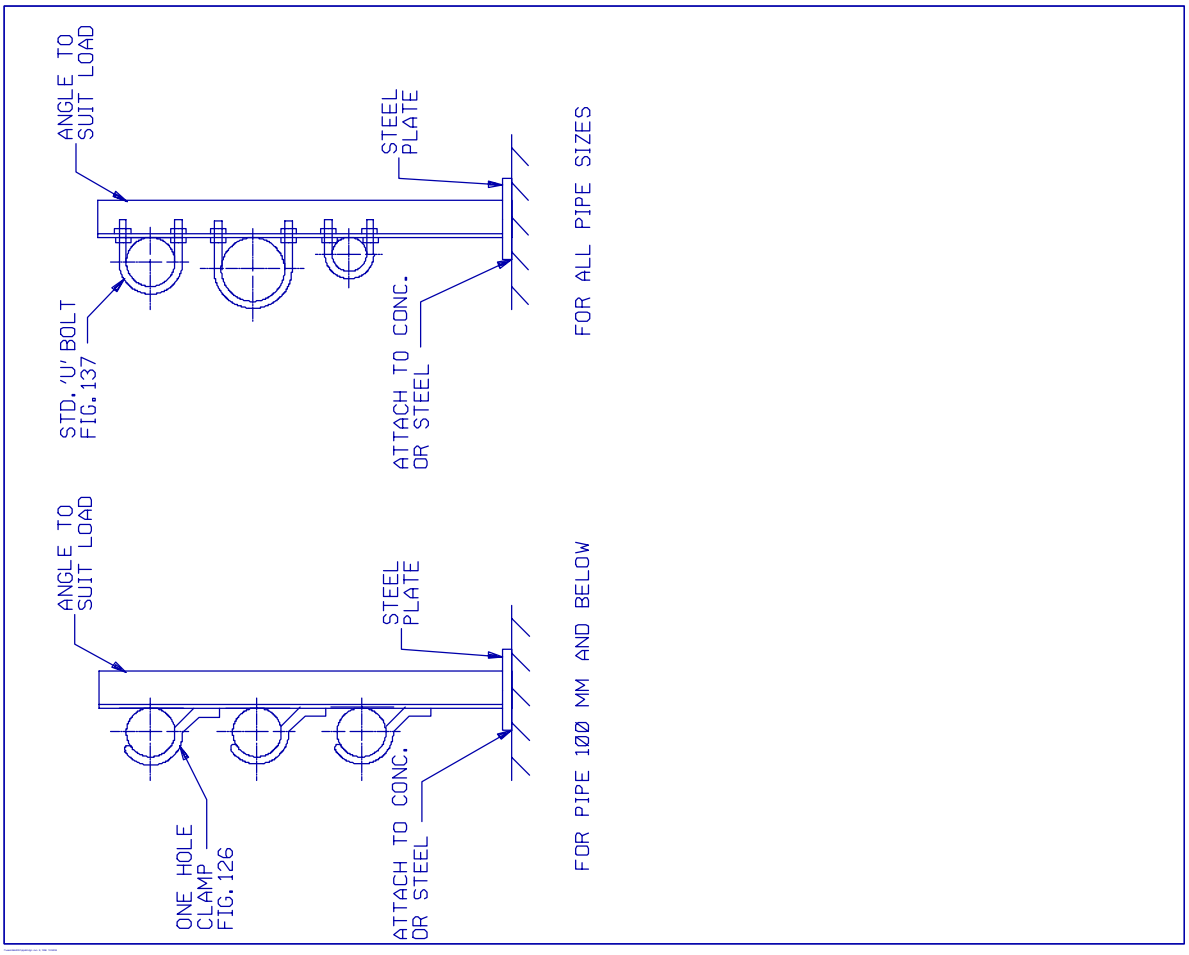
250 MM PIPE AND ABOVE.
ADD CENTRE GUSSET
FOR 400 MM AND OVER.

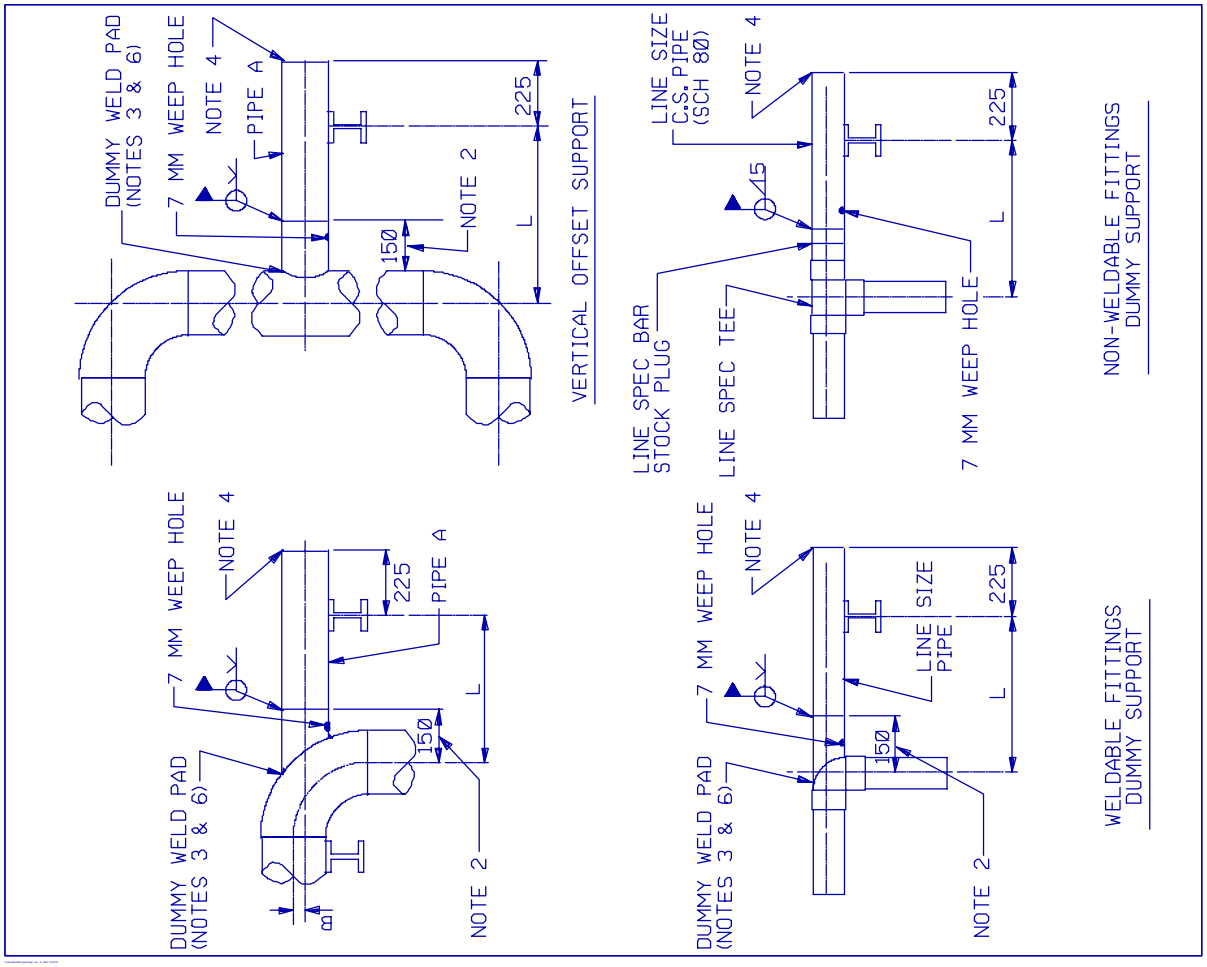
Pipe Size (in)	Pipe Size (mm)	Dim. 'A' (in)	Dim. 'A' (mm)
2	50	4	100
2 ½	65	4	100
3	80	4	100
4	100	4	100
6	150	4	100
8	200	4	100
10	250	4 ½	115
12	300	6	150
14	350	6	150
16	400	8	200
18	450	10	250
20	500	10	250
24	600	12	300

Shoes for pipes 2" (50 mm) through 16" (400 mm) shall be fabricated from 3/8" (10 mm) plate. 18" (450 mm) through 24" (600 mm) from ½" (15 mm) plate.




ANGLE FRAME
STEEL PLATE
ATTACH TO CONCRETE OR STEEL
STD. 'U' BOLT FIG. 137
STL. PLATE BOLT TO STL. OR CONC.
ATTACH TO CONCRETE OR STEEL
STD. 'U' BOLT FIG. 137
ANGLE FRAME
STEEL PLATE
STD. 'U' BOLT FIG. 137
SET IN CONCRETE ATTACH TO WALL OF TRENCH.
ANGLE


ANGLE TO SUIT LOAD
STEEL PLATE
STD. 'U' BOLT FIG. 137
ATTACH TO CONC. OR STEEL
FOR ALL PIPE SIZES
ANGLE TO SUIT LOAD
STEEL PLATE
ONE HOLE CLAMP FIG. 126
ATTACH TO CONC. OR STEEL
FOR PIPE 100 MM AND BELOW


DUMMY WELD PAD (NOTES 3 & 6)
7 MM WEEP HOLE
NOTE 4
PIPE A
225
NOTE 2
150
L
VERTICAL OFFSET SUPPORT
LINE SIZE C.S. PIPE (SCH 80)
NOTE 4
45
225
LINE SPEC BAR STOCK PLUG
LINE SPEC TEE
L
7 MM WEEP HOLE
NON-WELDABLE FITTINGS DUMMY SUPPORT
7 MM WEEP HOLE
NOTE 4
225
PIPE A
L
150
DUMMY WELD PAD (NOTES 3 & 6)
NOTE 2
7 MM WEEP HOLE
NOTE 4
LINE SIZE PIPE
225
L
150
DUMMY WELD PAD (NOTES 3 & 6)
NOTE 2
WELDABLE FITTINGS DUMMY SUPPORT

Main Line Size (mm)	Dimension L To 1500 mm max. Pipe A (mm)	Dim B (mm)	Over 1500 mm Pipe A (mm)	Dim B (mm)
50	40	6	40	6
80	50	14	50	14
100	80	13	80	13
150	80	40	100	27
200	100	52	150	25
250	150	52	200	27
300	150	78	200	52
350	200	68	250	41
400	200	94	250	67
450	200	119	250	92
500	250	118	300	92
600	250	168	300	143

Notes

1- Sizes and dimensions are in millimetres unless otherwise noted.

2- Dummy extension stubs shall be welded to the pipe spool before stress relieving. The remainder of the extension shall be field installed.

3- Do not burn hole in pipe when welding dummy extension. Weld rod shall be compatible with the line material. See project welding specifications.

4- Seal the end of the dummy extension pipe with 7 mm plate.

5- For Type 'A' dummy supports, dimension B = 0 mm when:

- ➢ Dummy support is supported by hanger.
- ➢ B.O.P. elevation of the main line and the dummy support are the same

6- Larger diameter light wall pipe or stress conditions may required a pad which shall be specified on a piping drawing or isometric.

7- Weep holes are to be sealed with mastic.

Line Material	Pipe A Schedule	Pipe A Material
5Cr-1/2Mo thru 9Cr-Mo above 400°C	12 to 40 mm - Sch 80 50 to 300 mm - Std Wt	5Cr-1/2Mo
Stainless Steel	Same as line	Same as line
All other carbon steel	12 to 40 mm - Sch 80 50 to 300 mm - Std Wt	Carbon steel

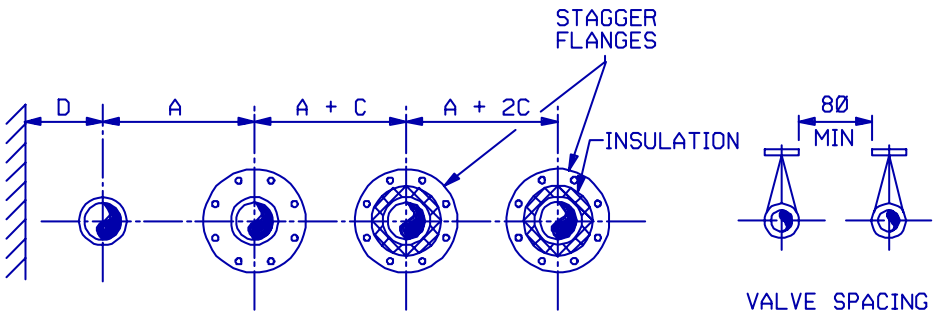
Support spacing shall be in accordance with ANSI B31.1 - Code for Pressure Piping (latest) edition. Table below to be used only as a guide

The spacing in this table is for insulated carbon steel pipe full of water.

Pipe Size (in)	**Pipe Size** (mm)	**Max. Span** (ft)	**Max. Span** (m)
1" & under	25 & under	7	2,150
1½"	40	9	2,750
2"	50	10	3,000
2½"	65	11	3,400
3"	80	12	3,700
4"	100	14	4,300
6"	150	17	5,000
8"	200	19	6,000
10"	250	22	6,700
12"	300	23	7,000
14"	350	25	7,000
16"	400	27	8,200
18"	450	28	8,500
20"	500	30	9,150
24"	600	32	9,800

Unless otherwise shown on drawings, the table below is to be followed for spacing of pipes:

STANDARD PIPE SPACING (mm) UNINSULATED PIPE DIM - "A" -															Additional Space to add for Insul. "C"	
Pipe Size	**25**	**40**	**50**	**80**	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**600**	**STD**	**D'STD**
600	530	530	530	560	585	610	635	660	690	690	710	710	760	815	25	50
500	460	480	480	480	510	535	560	585	610	635	660	685	710		25	50
450	430	430	430	460	485	510	530	560	585	585	610	635			25	75
400	405	405	405	430	430	460	480	530	560	585	585				25	75
350	355	380	380	405	405	430	460	480	510	530					50	75
300	330	355	355	355	380	405	430	460	480						50	75
250	305	305	305	330	330	355	380	430							50	75
200	280	280	280	305	305	330	355								50	75
150	230	255	255	255	280	305									50	75
100	200	200	230	230	255										50	75
80	180	180	205	205											50	75
50	150	180	180												50	75
40	150	150													50	75
25	125														50	75
	125	**150**	**150**	**180**	**180**	**230**	**255**	**280**	**330**	**360**	**380**	**405**	**460**	**510**		
CLEARANCE - "D"																



Notes:

- Spacing shown is for lines having 10, 16, and 25 Bar flange. For lines 100 mm and larger with 40 bar flanges add 50 mm to "A" spacing given in table above.
- Where insulation spacing table "C" is less than insulation thickness given on piping diagram or specification, increase dimensions accordingly.
- Spacing shall be increased:
  - when flanges are in line, as in valve manifolds (see valve spacing).
  - where lateral movement is anticipated.
  - where hand wheel dia. does not permit 80 spacing between handles.

END OF SECTION

1. PIPING MATERIAL SPECIFICATION - C1D1

1.1 Design

1.1.1 Max 400 kPa(g) at 82 °C.

1.1.2 All piping components must conform to low temperature service.

1.1.3 Design to ASME B31.3 process piping code.

1.2 Test

Hydrostatic: 600 kPa(g) for 2 hours

Pneumatic: 440 kPa(g) for 2 hours △2

1.3 Services

DIESEL OIL (LDO)

1.4 Materials

DESIGNATION	NOMINAL DIAMETRE (DN)	DESCRIPTION	WALL THK OR RATING	
PIPE	15-50	PIPE, CARBON STEEL SEAMLESS ASTM-A333/A GRADE 6	SCH. 80	
	80-600	PIPE, CARBON STEEL SEAMLESS ASTM-A333/A GRADE 6	STD	
FITTINGS	15-50	CS, SMLS, SW,ANSI B16.9, ASTM-A350 GR. LF-2	3000LB	
	80-600	CS, SMLS, BW, ANSI B16.9, ASTM-A350 GR. LF-2	STD	
UNIONS	15-80	CS, ANSI B16.9, ASTM-A350 GR. LF-2	3000LB	
FLANGES	80-600	R.F. BLIND FLANGE, ANSI B16.5 ASTM-A350 LF-2	150LB	△2
	80-600	R.F. WELD NECK FLANGE, ANSI B16.5 ASTM-A350 LF-2	150LB	
GASKETS	80-600	SPIRAL-WOUND GASKET 4.4MM THICK, SS RINGS, GRAPHITE FILLER, GARLOCK RWI, ASME B16.20	150LB	△2
BOLTING	50-600	STUD TO ASTM A193 Gr B7 C/W TWO NUTS TO ASTM A194 Gr 2H		

DESIGNATION	NOMINAL DIAMETRE (DN)	DESCRIPTION	WALL THK OR RATING
		VALVES AND ACCESSORIES	
GATE VALVE	80-600	RF, RS, OS & Y, BOLTED BONNET, HALF-STELLITE TRIM ASME B16.34 ASTM A351 LCC, CRANE FIG 47LUF	150
GATE VALVE WITH RELIEF VALVE	100	RF, RS, OS & Y, BOLTED BONNET, HALF-STELLITE TRIM ASME B16.34 ASTM A351 LCC, CRANE FIG 47LUF SAFETY RELIEF VALVE CONBRACO FIG 511DCB DN15/DN25 RELIEF VALVE PIPED DN15 TO GATE VALVE BOSSES A&B	150
DUO CHEK	80-150	WAFER AND LUG SS316, ASME B16.34 CRANE FIG 4G15CPF	150

2. NOTES

2.1 W.N. flange bore to suit pipe schedule.

2.2 R.F. flanges shall only be used when mating to same.

2.3 Surface finishes for flange faces shall be in the range of 250 to 500 RMS.

Rev	Issued for	Date	Prepared by	Reviewed by	Approved by
0	Design/Construction	25/10/04	K. Lemcelli		
1	Squad check	22/10/04	J.-C. Paradis	K. Lemcelli	
2	FF flanges removed, pneumatic testing added, gasket description updated	14/01/05			2005/01/14

END OF SECTION

1. CODES AND STANDARDS

1.1 All materials, works and work methods shall conform to construction codes, local, provincial, national codes, to regulations of authorities having jurisdiction on the works, and to the codes and standards noted below. In the case of conflict between regulations of competent authorities, the most severe requirements shall prevail.

- EFC: Electro-Federation of Canada (formerly EMAC)
- ASTM: American Society for Testing Materials
- CSA: Canadian Standards Association
- CGSB: Canadian Government Specifications Board
- ANSI: American National Standards Institute
- IEEE: Institute of Electrical and Electronic Engineers
- ISA: Instrument Society of America
- Canadian Electrical Code

1.2 Only the latest edition of pertinent codes and standards shall prevail, including addenda, supplements and revisions in force at the time of award of contract.

1.3 The Vendor shall ascertain that his designs conform to the various applicable safety requirements.

2. PERMIT FEES

2.1 Forward a copy of the drawings, and technical specifications to the Office of Electrical Installation inspection to allow them to study and approve the documents prior to the start of work.

2.2 Pay all the pertinent permit fees prior to the start of work.

3. INSPECTION

At the completion of work, obtain an acceptance certificate issued by the inspection organization.

4. MATERIALS AND EQUIPMENTS

4.1 General

4.1.1 Supply the materials and equipments in conformity with the specifications and drawings.

4.1.2 Supply* and install scaffolding in areas where required and furnish necessary equipments for the installation of same.

4.1.3 The materials and equipments shall be approved by CSA and fabricated in conformity with stipulated standards.

4.1.4 In the case where there is no other choice than to supply equipment not sanctioned by CSA, obtain a special approval from the inspection organization.

4.1.5 All materials shall be new and free of defects.

** Not applicable.*

4.2 Standard Specifications

This section specifies electrical appliances and equipment which shall be used in this installation. Since it is a standard specification, all the equipment specified is not necessarily required for this particular project.

4.2.1 Breakers

4.2.1.1 Breakers 120, 240, 208 Volts: Westinghouse, SQ.D, G.E., interrupting capacity 10 KA min.

4.2.1.2 Breakers 347-600 Volts: Westinghouse, type FD, interrupting capacity 18KA min.

4.2.2 Manual Starters

Cutler Hammer, enclosure EFC type 12

4.2.3 Starters or Modular Control Centres (600 Volts)

4.2.3.1 Combined with breakers and coil capable of operating between 105 and 130 Volts continuous rating.

4.2.3.2 Short circuit capacity, 42 KA minimum.

4.2.3.3 Allen-Bradley, Westinghouse, Cutler Hammer.

NOTE: Where variable speed is required, "Relcon" PWM type variable frequency controller shall be supplied. Units shall be suitably sized to meet motor characteristics and operating parameters and shipped loose in an "EFC" type 12 (formerly EEMAC) enclosure.

4.2.4 Cables

All cables shall be certified "HL" for use in an explosive environment to conform to CSA Standard C22.2 #174-M81, and pass inflammability flame propagation delay and generation of acidic gasses test(s) as per Hydro Ontario #L-891SM-77 and CSA C22.2 #0.3 (FT4). The internal and external casings shall meet temperature requirements of 90 C, -40 C.

4.2.4.1 Power Cables: Teck R-90, X-Link-40, #12 AWG minimum, stranded copper, insulated for 1,000 Volts minimum.

4.2.4.2 Control Cables: All control cables shall conform to CSA Standard C21.1. They shall be of "Teck" type construction, aluminium interlocked armour and stranded copper conductor Class "B" #14 AWG 600 Volts. These cables shall have an exterior jacket of black extruded PVC.

4.2.4.3 Instrumentation Cables: All twisted cables in pairs or triads shall conform to CSA Standard C21.2. They shall be of "Teck" type construction #16 AWG, aluminium interlocked armour for instrumentation. The conductor insulation shall be rated at 600 Volts. Furthermore, the pairs and triads shall be of twisted stranded copper conductor construction and individually electro statically shielded by means tape fitted with a bare stranded copper drain wire. Additional shielding, as described above shall also cover all pairs and triads. In all cases, the cables shall have an exterior jacket of yellow, blue, grey or black extruded PVC.

4.2.4.4 Cabling for High Temperature Areas: Not applicable.

4.2.4.5 Communication Cable: Communication cables shall conform to the specifications as per the cable list. If a communication cable is outside a panel or protection box and is not armoured, it shall be enclosed in a flexible metallic conduit for mechanical protection.

4.2.4.6 Portable Flexible Cables: Type SOW 90 C, 600 Volts, neoprene jacket, heavy service for exterior use with a base or insulated conductor, green colour, suitable for grounding.

4.2.4.7 Other Cables: Certain special cables may be required and supplied. The Vendor shall specify these cables for approval by the Engineer, complete with installation instructions.

4.2.5 Wiring for Appliances

Type TEW 600 Volts - 105°C

- 16 gauge AWG: depending on the application (submitted for approval by the Engineer).
- 14 gauge AWG: control wiring only.
- 12 gauge AWG: for power, lighting and outlets.

4.2.6 Identification

4.2.6.1 Wires:

- Identified with slip on markers Weidmuller type PA 1/3, black letters on yellow background.

4.2.6.2 Cables:

- ➢ Identified with channel-type Electrovert Unilabel Cat. #ELV-688-12, black letters on a white background.

4.2.7 Cabinets and Consoles

Hammond, EFC 12 enclosure, with internal mounting plate painted with white enamel and exterior painted light grey ASA-61.

4.2.8 Push-Buttons and Selector Switches

Allen-Bradley bulletin 800-H, EFC 9EFG.

4.2.9 Electrical Outlet

Hubbel complete with "U" grounding (specification grade).

4.2.10 Covers for Electrical Outlet

4.2.10.1 Hubbel 5206 or 7418

4.2.10.2 Crouse-Hinds DS70-G

4.2.11 600 Volts Electrical Outlet

Crouse-Hinds 56742, 60 amps, 3 wires - 4 poles C/W 70 amp breaker, WESCO type FA-3070 with terminals 6293 - 100G02 100 amps.

4.2.12 Teck Cable Connectors

4.2.12.1 Use watertight cable connectors for Teck cable steel construction type "Star-Teck" as fabricated by "Thomas and Betts" series "10000" in steel with watertight washers for each cable entry in all enclosures;

4.2.12.2 If any areas are specifically identified in location diagrams as having explosion risks, only special "Teck" connectors type "Spin-on 3" as fabricated by "Thomas and Betts" shall be used;

4.2.12.3 For flexible cables, "Max-Loc" connectors as fabricated by "Woodhead" shall be used. These connectors are used with a support cage of braided stainless steel for vertical installations of cables non-supported for more than 1,500 mm.

4.2.13 Lugs

4.2.13.1 Type Cu/A2, long barrel, pre-insulated with nylon nipple, high dielectric efficiency for #14 and #10 wires;

4.2.13.2 Compression clips, tinned copper plates, "Thomas and Betts", series 54.

4.2.14 Terminal Strips (Blocks)

4.2.14.1 Type Cu/A2, 25A, 600 Volts min., tubular type screw with bearing plate and identification surface, as supplied by Weidmuller.4.2.15 Conduit

4.2.14.2 In standard rigid galvanized steel, threaded (¾") minimum.

4.2.15 Condulets

Crouse-Hinds - Form 8.

4.2.16 Metallic Flexible Conduits

Waterproof with a fireproof PVC casing, ½" minimum.

4.2.17 Fittings for Flexible Metallic Conduits

Insulated throat, waterproof, type "Thomas and Betts".

4.2.18 Bus bars

Panels for power, lighting, and distribution shall be equipped with plated copper bars.

4.2.19 Distribution Cabinets

Steel, with no knockout panel - EFC 12, with copper bus bar.

4.2.20 Cable Trays

Ladder type, spaced 12", galvanized steel, 65 lb/foot capacity, 4" or 6" deep, as supplied by Burndy, Electrovert or equivalent.

4.2.21 Cable Attachments in Cable Trays

4.2.21.1 Attachments for large cables shall be type "P" metallic, suitable for installation in vertical and horizontal sections.

4.2.21.2 Attachments for small cables shall be type "P" metallic, for installation in vertical sections. It is not necessary to attach small cables in horizontal sections.

4.2.22 Junction Boxes

Steel, without knockouts, EFC 12 for interior use, and EFC 4 for exterior use. 8" X 8" X 4" minimum complete with cover with a neoprene impervious joint.

4.2.23 Limit Switches

4.2.23.1 Allen-Bradley Bulletin 802;

4.2.23.2 CCL Silvania type HLA, heavy duty service, (submitted to the Engineer for approval).

4.2.24 Timing/time Relay (Mechanical or Electronic)

Potter Brumfield CD, Electromatic model 55, OMRON H3, Syrelec M813.

4.2.25 Control Relays

4.2.25.1 Potter and Brumfield KRP, KHP, KHS, KHY, KHU;

4.2.25.2 Allen-Bradley, Bull 700, 10A, 120 AC.

4.2.26 Overload Relays

3-phase protection:

- Westinghouse;
- Allen-Bradley;
- Cutler-Hammer.

4.2.27 Control Transformers

600 - 120 Volts, 1PH

- 100 VA for size 1 starter;
- 150 VA for size 2 starter;
- 250 VA for size 3 starter;
- 300 VA for size 4 starter;
- 350 VA for size 5 starter.

4.2.28 Fuses

4.2.28.1 Standard type "D" or "P" for 240 Volt potential or less.

4.2.28.2 Type HRC for 1, Class "J" for 600/347 Volt potential (fast acting).

4.2.28.3 Type ED for heating unit protection.

4.2.29 Pilot Lights

120 Volts, 60 HZ with transformer. Type "LED" Allen-Bradley, #800T-PL16 or incandescent type #800-P16.

4.2.30 Apparatus Identification

4.2.30.1 In white laminated, engraved plastic, black letters for interior use, or in white anodized aluminium, black letters for exterior use;

4.2.30.2 Fastening:

- "Hermés" glue (interior);
- Spiral rivets (exterior).

4.2.31 Disconnect Switch

Heavy duty, quick opening and closing, mechanism permitting padlocking the switch in "off" position, equipped with a device allowing opening of the door by authorized personnel while the equipment is under tension. Suppliers: Westinghouse, S.Q.D., F.P.E.

4.2.32 Transformers

Dry type, ventilated, copper windings with Class "F" insulation. Suppliers: Hammond or Polygon.

4.2.33 Heating and Ventilation

4.2.33.1	Unit heaters:	"Caloritech", model "GX", 575 Volts, with integral 120 VAC control and integral thermostat.
4.2.33.2	Baseboard:	Chromalox or equivalent 208 or 600 Volts
4.2.33.3	Control:	120 Volt or 24 Volt control.
4.2.33.4	Thermostat:	Honeywell or equivalent for industrial use.
4.2.33.5	Heating coils:	Thermolec or equivalent, complete with 3 poles contactor.
4.2.33.6	Controller:	"SRC", 600 Volts model R7393 A - 1 phase R7393 B - 3 phases
4.2.33.7	Potentiometer:	135 ohms

4.2.34 Grounding

A copper clip for grounding, which shall conform to CSA standards, shall be supplied with equipments.

4.2.35 Tracing Cables

Raychem, Chemelex type "BTV" 120 or 240 Volts, self-regulated.

4.2.36 Reference Table

4.2.36.1 Table, steel, light grey ASA-61, Federal Steel Equipment Ltd.

4.2.36.2 Cat No. B-LW-3060 + #211 g.

5. FINISHING

Clean, prime and paint all visible anchoring devices, such as hangers, supports, attachments, to protect from rusting. Apply paint prior to installation and touch-up after installation.

6. NAME PLATES

6.1 Nameplates required for panels, starter enclosures, switches and other equipments and appliances requiring identification, shall be supplied by the Vendor.

6.2 The inscriptions shall be given by the Engineer.

6.3 All nameplates shall carry the drawing number of the single line diagram, panel schedule, and schematic diagram, etc.

7. WIRING DESIGNATION

7.1 Maintain the order of the phases and the same colour code for the complete installation.

7.2 The colour code shall conform to CSA C222.10 - 1992.

8. CABLE TRAYS

8.1 Cable Routing - Identification

All cable trays installed and existing where cables are to be installed shall be identified with letters 75 mm (3" high) in black enamel paint on the side of the cable tray showing the number as per lay out drawings.

8.2 Cable Tray Supports

Supports shall be spaced 3,000 mm (10') maximum. The maximum distance between a joint and the nearest support shall be 760 mm (2'-6").

8.3 Cable Tray Grounding

A bare copper grounding cable #4/0 AWG shall be installed in each run of cable tray(s). The grounding cable shall be anchored at 15,250 mm (50') intervals on the tray as per article 12-2210 of the Canadian Electrical Code, CSA publication C22.10 - 1992.

8.4 Prefabricated Cable Trays

Tees, elbows, and elevation changes indicated on the drawings shall be of the prefabricated type, non adjustable, the minimum interior curvature radius shall be 500 mm (20") minimum.

8.5 Field Fabricated Cable Trays

The connection for field fabricated cable trays shall have rounded corners or bevelled, the interior curvature radius shall be 500 mm (20") minimum.

8.6 Cable Tray - Accessories

Accessories shall be of the same make as the cable trays supplied.

8.7 Cable Trays - Installation

8.7.1 The clearance between two (2) superimposed cable trays shall be 300 mm (12") minimum. The building structural steel shall not be pierced to anchor the cable trays, except with permission from the Engineer. An adequate mechanical protection is required if the cable tray is susceptible to mechanical damages, in particular in areas where vehicles circulate or where ice can fall form a roof. The drawings indicate the approximate location of the cable trays. The Contractor shall determine the exact location on site, accompanied by the Engineer. If the agreement is not respected, the Contractor shall carry out modifications at his cost. A vertical clearance of 600 mm (24") is required between the top of an MCC and a cable tray.

8.7.1.1 If the Contractor installs the cable trays, the location diagrams define the preferred installation area. It is the Contractor's responsibility to determine the exact location with the least possible divergence from the drawings. The Contractor shall also obtain the approval of the Engineer. Finally, any networks of cable trays is prohibited in areas identified on location diagrams where temperatures can reach 80º C (175º F) or more.

8.7.1.2 Cable tray supports shall be spaced at a maximum of 3,000 mm (10') and always located at least 750 mm (30") from any joint or transition fitting.

8.7.1.3 The supports and anchors shall have sufficient strength to support the loaded cable trays at their maximum, independent of the number of cables installed in each one in accordance with this contract.

8.7.1.4 The cable trays shall not be used as walkways, either during installation, pulling cables or at any other time.

8.7.1.5 To install new cables in existing cable trays, the Contractor shall verify the purpose of existing cables and if the purpose is different, add a continuous metallic divider to separate the new and existing cables.

8.7.1.6 Different purposes is defined as follows:

- ➢ control cable 120 Volts, 600 Volts;
- ➢ instrumentation cable for analog signal transmission, multi signals, television, communication, etc.

8.7.1.7 Dividers are required to separate instrumentation cables from other types.

8.8 Cable Trays - Cable Attachments

All clamping devices, small or large shall be spaced at 1,500 mm (5').

8.9 Cable Trays - Welding

Weldments on the structure shall be cleaned and touched-up with an epoxy finish print coat - International Ltd. "Integral Series Exhib mastic", 0.005" dry coat thickness, colour leaf green #934.

9. INSTALLATION HEIGHT

In the case that the installed height of equipment is not indicated, verify with the Engineer prior to installing.

10. RIGID CONDUITS - CONNECTIONS

Connections at boxes shall be dust proof and waterproof, using standard "O" rings for electrical installations.

11. PROTECTION

During construction works, exposed or "live" materials shall be protected to assure the safety of personnel and equipment integrity.

12. LOAD BALANCING

12.1 For equipment commissioned by the Contractor, measure the phase and current of the distribution boards functioning under normal loads (lighting) at the time of acceptance. When necessary, re-route the circuits in a way to obtain the best current balance between different phases, and note the modifications carried out to the original connections on the "as-built" drawings.

12.2 At the completion of the work, submit a report indicating the current rating under normal load as taken from the phases and neutrals of the distribution boards.

13. FIRE BREAK SEPARATORS

When cables or conduits pass through flame barrier floors or walls, the Contractor shall construct openings as shown on the drawings and seal same as required, using silicon foam "Dow Corning" or "CGE" with a mineral product plate (combustion resistant) both sides, or approved equivalent.

14. CLEANING

During final cleaning, clean all equipment and the interior of panels and junction boxes with a vacuum cleaner.

15. DEVIATION BETWEEN DOCUMENTS

In the case of divergence between the drawings and specifications, the Engineer must be notified immediately.

16. HARDWARE

16.1 Use Bolts, dowels, nuts, locknuts, washers, clips, etc., in stainless steel, cadmium plated steel or galvanized steel.

16.2 All bolted connections or dowels with tightening nuts shall be fitted with "Belleville" washers to ascertain a constant pressure independent of thermal cycling.

16.3 The use of beam clamps to attach "Teck" cables to structural members is not permitted.

END OF SECTION