



Piping Trades' Trade Assessment

Introduction

The Piping Trades' Trade Assessment is used to measure your readiness to enter a full apprenticeship and to attend technical training. Technical training is part of your apprenticeship. The skills tested include reading, using tables and diagrams, and solving problems which involve numbers.

The questions are set up to test your ability to think and solve problems. They are not meant to trick you. Although some of the work situations may not be familiar to you, all of the information you need to solve the problem is in the material provided. You may use your calculator for the entire assessment.

Do not just write the answer to the question. Show all of your work.

The questions are grouped in to four sections.

Section 1: Math Foundations

The first section tests basic math skills: whole numbers, decimals, fractions, imperial measurement and metric measurement.

Section 2: Word Problems

The second section tests more complex math skills and requires you to set up and solve math problems. Some problems require you to use information from tables and diagrams. Although you are given a list of formulas, you are required to decide which formula to use. Remember to show your work.

Section 3: Science

The third section test your knowledge of basic science concepts including changes of state: solids liquids and gases, calculating BTUs (British Thermal Units), force and pressure, Ohm's Law, heat transfer and gas laws.

Section 4: Problem Sets

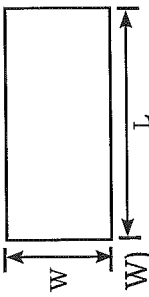
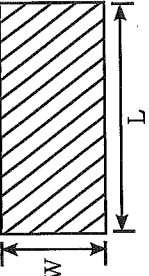
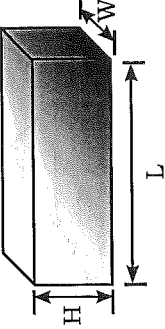
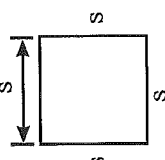
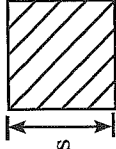
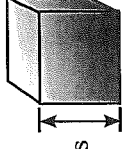
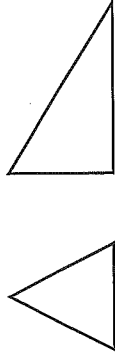
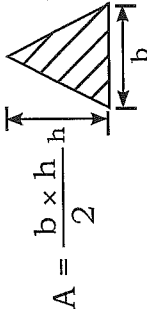
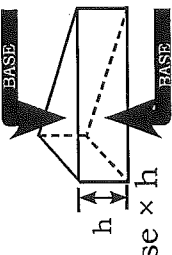
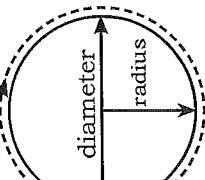
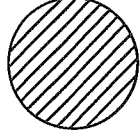
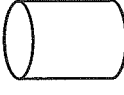

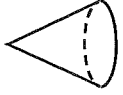
The fourth section has questions which are grouped in problem sets. Each problem set asks questions relating to a workplace document. All the information you need to answer the questions is in the workplace document. The documents include reading selection, code and regulations, drawings, tables and diagrams.



Instructions

- Take a couple of minutes to look through the entire assessment.
- Do not rush through the assessment; work carefully.
- Do rough work in the space provided.
- Print answers clearly. If the answer cannot be read, it will be marked incorrect.
- You may use a calculator through the entire assessment.
- Try every question. The questions are not ordered according to difficulty.
- If you find a question difficult, move on to the next question and come back later.
- If you decide to change an answer, make sure you cross out the old answer.



FORMULAS FOR PERIMETER, AREA AND VOLUME		
Perimeter 1 - Dimensional	Area 2 - Dimensional	Volume 3 - Dimensional
 $P = 2 \times (L + W)$	 $A = L \times W$	 $V = L \times W \times H$
 $P = 4 \times s$	 $A = s^2$	 $V = s^3$
 $P = s_1 + s_2 + s_3$	 $A = \frac{b \times h}{2}$	 $V = \text{area of base} \times h$
 $C = \pi \times d$ diameter = 2 × radius radius = diameter ÷ 2	 $A = d^2 \times 0.7854$	 Lateral area (side walls) of a cylinder or pipe $LA = \pi \times d \times h$
 $V = d^2 \times 0.7854 \times h$	 $V = \frac{d^2 \times 0.7854 \times h}{3}$	

TRIGONOMETRY	PYTHAGOREAN THEOREM (3-4-5 METHOD)
<p style="text-align: center;">SOH CAH TOA</p>	$a^2 + b^2 = c^2$ $a^2 = c^2 - b^2$ $b^2 = c^2 - a^2$
CONVERSION AND CONSTANTS	
<p>1 ft = 12 in 1 yd = 3 ft 1 m = 1 000 mm 1 m = 100 cm 1 cm = 10 mm 1 in = 25.4 mm 1 m³ = 1 000 litres</p>	<p>1 ft² = 144 in² 1 ft³ = 1728 in³ 1 ft³ = 6.24 imperial gallons 1 ft³ = 7.48 US gallons 1 m³ = 220.33 imperial gallons 1 m³ = 264.39 US gallons 1 ft³ of water = 62.4 lbs 1 m³ of water = 2 203.3 lbs</p>

**Math Operations**

1) $23.85 + 412.6 + 0.995 + 2.4 =$

2) $36.25 \times 9 =$

3) $627 \div 3 =$

4) Write the answer in lowest terms.

$$6\frac{1}{2} + 3\frac{3}{4} =$$

5) Write the answer in lowest terms.

$$11\frac{13}{16} - 5\frac{1}{2} =$$

6) Write the answer in lowest terms.

$$2\frac{5}{8} \times 3 =$$

7) Write the answer in lowest terms.

$$16\frac{3}{4} \div 2 =$$

8) Write the answer in simplest form.

$$3' 4\frac{1}{2}'' + 8' 9\frac{3}{4}'' =$$



9) Convert $\frac{7}{8}$ to a decimal.

10) List the fractions from **smallest** to **largest**:

$$\frac{3}{4}, \frac{1}{2}, \frac{5}{8}, \frac{11}{16}, \frac{7}{8}$$

11) List the decimals from **largest** to **smallest**:

$$0.703, 0.8, 0.085, 0.73$$

12) Round 3.14159265 to the nearest thousandth.

13) 25% of 320 = _____

14) $5^2 =$ _____

$$15) \frac{3}{4} = \frac{\quad}{96}$$

16) 3.295 m = _____ mm

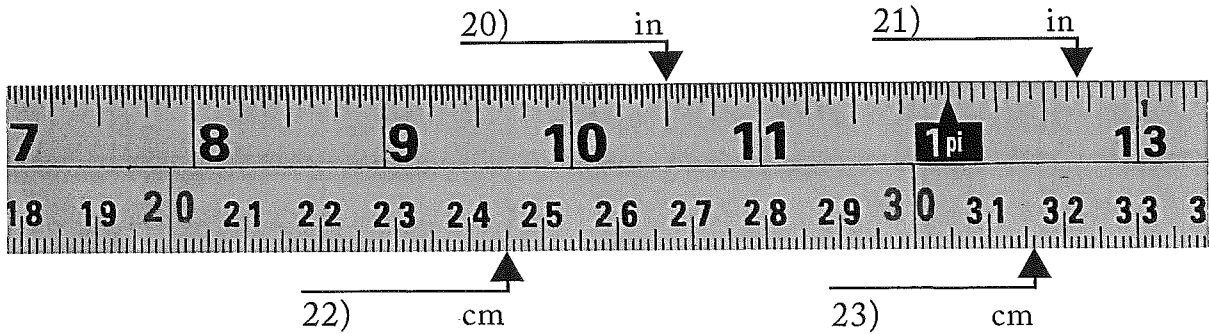
17) 36" = _____ ft

18) 12" = _____ cm

19) 9 inches = _____ ft



Write the measurement marked with arrows.

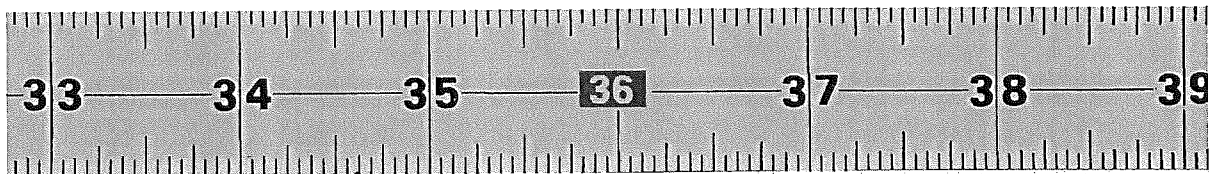


Mark the tape measure with an arrow at the following measurements.

24) $34 \frac{1}{4}$ inches

25) 3 feet

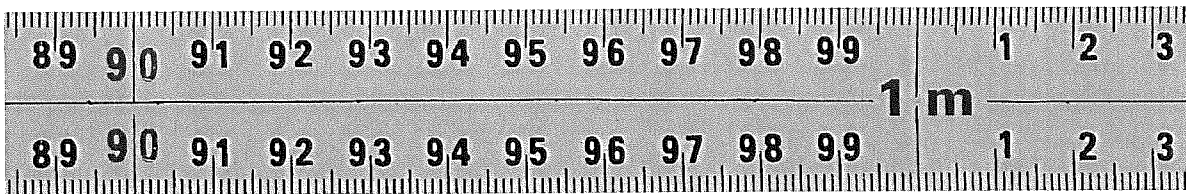
26) $37 \frac{7}{8}$ inches



Mark the tape measure with an arrow at the following measurements.

27) 94.5 cm

28) 1.02 m







Word Problems

- 1) A 12-inch steel pipe runs a length of 82.5 feet and contains water. Calculate the weight of the pipe and the water it contains using the pipe data table. Round to the nearest whole pound.

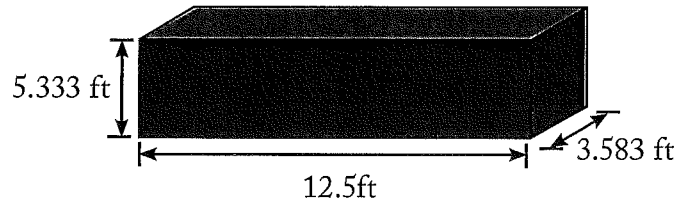
Weight class	Sch#	Inside diameter	Wall thickness	Outside area	Inside area	Plain end weight	Water in pipe
		Inches	Inches	ft ² /ft	ft ² /ft	lb/ft	lb/ft
STD	40	11.938	0.406	3.338	3.125	53.52	48.51

- 2) Calculate the travel for a 22 ¹/₂° elbow with a run of 406 mm. Round to the nearest millimetre.

258 PIPE OFFSETS		Offset Methods/Constant Multiplier					
<i>Imperial Calculations:</i>		<i>Metric Calculations:</i>					
Travel = 12 inches x 1.082		Travel = 304.8 mm x 1.082					
= 12.984 inches (1 ft. x 1 in.)		= 329.8 mm					
		CONSTANTS AND FORMULAS FOR CALCULATING COMMON OFFSETS					
		Elbow Fitting Angles					
Formula	72° Elbow	60° Elbow	45° Elbow	30° Elbow	22 1/2° Elbow	11 1/4° Elbow	5 5/8° Elbow
Travel = Offset x	1.052	1.155	1.414	2.000	2.613	5.126	10.187
Travel = Run or Rise x	3.236	2.000	1.414	1.155	1.082	1.019	1.004
Run or Rise = Offset x	0.325	0.577	1.000	1.732	2.414	5.027	10.158
Run or Rise = Travel x	0.309	0.500	0.707	0.866	0.924	0.980	0.995
Offset = Travel x	0.951	0.866	0.707	0.500	0.383	0.195	0.095
Offset = Run or Rise x	3.078	1.732	1.000	0.577	0.414	0.198	0.098



- 3) Calculate the capacity in imperial gallons.
Refer to Table 1: Conversions and Constants, found at the beginning of the assessment.



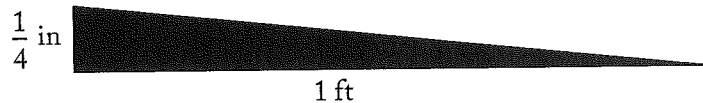
- 4) Solvent cementing is used to join ABS pipe and fittings. 250 mm diameter pipe requires 24 hours for the joints to cure before testing or line pressure can be applied. Calculate the length of time if 50% more cure time is required in damp or humid conditions.



- 5) An apprentice earns 65% of a journeyman's wage. The journeyman earns \$42.65/hr. How much does the apprentice earn in a 40-hour work week?

- 6) Plumbing pipes need to be installed with a slight slope to ensure drainage. 2 ½ inch pipe is sloped at a ratio of ¼ inch down for every 1 foot in pipe length (¼ inch:1 foot)

Calculate the vertical drop in inches for a pipe that is 68 feet long.



- 7) Fittings such as elbows and tees are used to change direction in a piping system. Piping diagrams usually show the measurements for pipe as centre to centre (c-c), which means the measurement from the centre of the fitting on one end of the pipe to the centre of the fitting on the other end of the pipe. Because the straight pipe cannot actually run to the centre of a fitting, the end to end (e-e) measurement of the pipe needs to be calculated. The e-e measurement is the actual length of the pipe that needs to be cut and then threaded. The thread make-up is the threaded section at each end of the pipe that screws into the fitting.

Use the piping diagram to calculate the e-e measurement.

- The pipe size is 1 1/4 "
- The c-c measurement is 24 inches.
- Two 45° elbows

$$e-e = c-c \text{ measurement} - (\text{Dim B}) - (\text{Dim B}) + (2 \times \text{thread make-up})$$

Piping Definitions

c-c measurement from centre of fitting to centre of fitting

e-e: length of pipe that needs to be cut

A: takeoff for a 90° elbow or tee

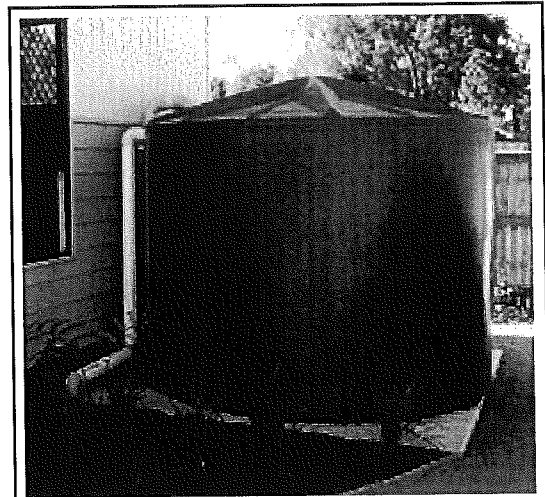
B: takeoff for a 45° elbow or tee

E: thread make-up

Measurements for Fittings				
Pipe Size	Dimension A	Dimension B		Thread Make-up E
		45°	22.5°	
1/2"	1 1/8"	7/8"		1/2"
3/4"	1 5/16"	1"	7/8"	9/16"
1"	1 1/2"	1 1/8"	1"	11/16"
1 1/4"	1 3/4"	1 5/16"	1 1/8"	11/16"
1 1/2"	1 5/8"	1 7/16"	1 1/4"	11/16"
2"	2 1/4"	1 11/16"	1 7/16"	3/4"

*Note: Use Dimension A for tees and 90° elbows
Use Dimension B for 45° and 22.5° elbows.*

- 8) What is the total weight of the vessel when it is full of water? Round to the nearest kilogram.

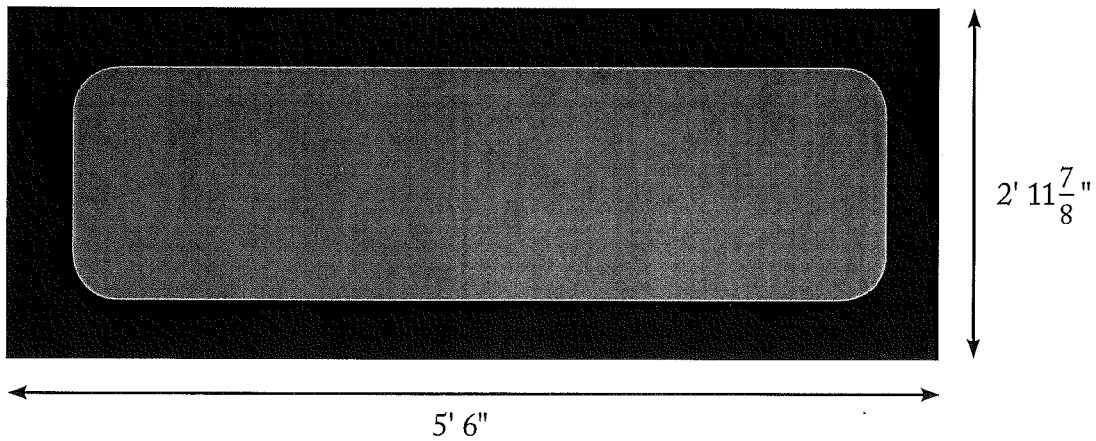


Height = 1 220 mm
 Diameter = 1 524 mm
 Vessel weight = 45.36 kg

Water

$1 \text{ m}^3 = 1\,000 \text{ L}$
 $1 \text{ L} = 1 \text{ kg}$

9) Calculate outer perimeter of the tub in feet, inches, fractions of an inch.



10) Calculate the total material cost.

	Qty.	Description	Unit price	Item cost
1.	2	Toilet wax bowl ring with sleeve & 2 1/4 inch brass bolts	7.40	
2.	2	Click Seal 3/8 in. x 1/2 in. x 20 in. toilet connector	8.97	
3.	2	Tofino dual flush complete one piece 1.08/1.59 gal. elongated toilet	269.00	
4.	2	Cachet Quiet-Close elongated toilet seat, white	58.00	
			subtotal	
			12% taxes	
			TOTAL	

**Science**

- 1) When installing pumps, workers in the piping trades work with electrical circuits. The amount of electricity flowing into a pump must be enough to keep the pump running, but not so much that it would burn out the motor and fry the wiring. They use Ohm's Law, which shows the relationship between voltage, current and resistance.

Ohm's Law is $E = I \times R$

E = voltage, in volts (V)

I = current, in amperes (A)

R = resistance, in ohms (Ω)

A circuit has a 220V power source, a switch and a pump. When the switch is turned on, 8A of current flows in the circuit. What is the resistance of the pump?

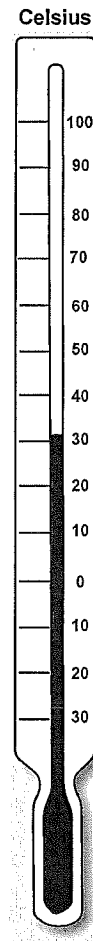
- 2) High water pressure is a major cause of leaks and pipe damage. When water pressure is too high, property owners may see leaks at multiple fixtures in the building. Pressure is calculated by dividing the weight in pounds by the area in square inches.

Calculate the pressure in pounds per square inch (psi) for the bottom of the tank. Round to the nearest thousandth.

The surface area of the bottom of the tank is 1 404 in². The weight of the water in the tank is 3 000 lbs.

3) On the thermometer, mark the temperatures at which:

- A. water boils
- B. water freezes



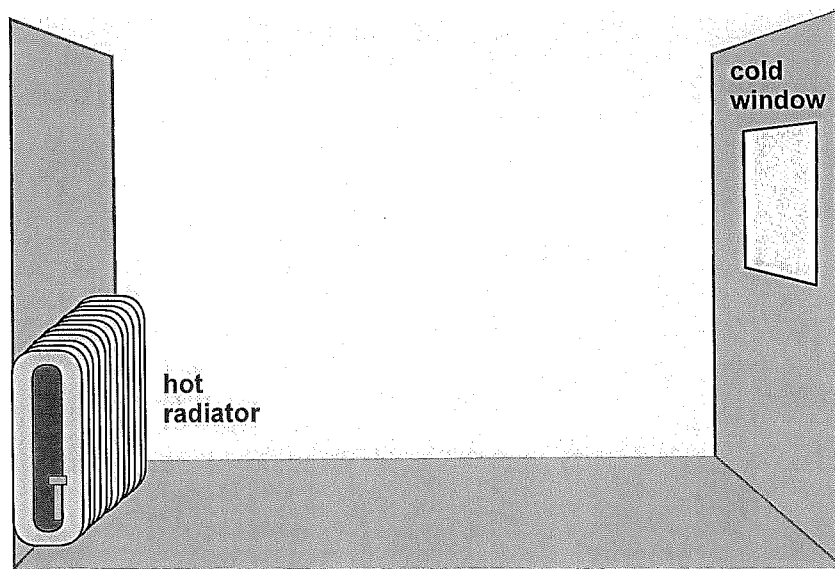
4) Gases and liquids contained in tanks and pipes expand and contract with changes in pressure and temperature. When the temperature is kept constant, what happens to the volume of steam when pressure increases?



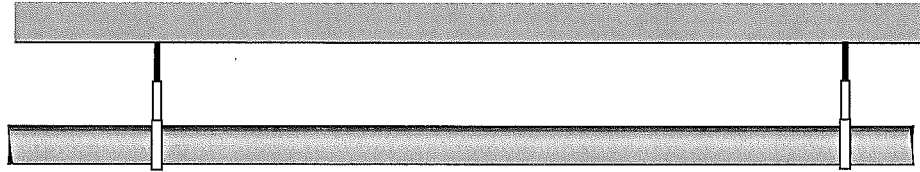
- 5) In the piping trades, the density of fluids such as diesel or oil are compared to the density of water. Density is a measure of weight per unit of volume.

The volume of water in a vessel is 15 cubic feet. The weight of the water is 936 pounds. Calculate the density of water.

- 6) A heater turned on in a cold room eventually warms up all the air in the whole room. Draw arrows to show the convection pattern of air movement as warm air leaves the heater and cold air is returned to the heater.



- 7) A steel pipe is installed on supports which will carry the weight of the pipe and contents. When put into service, the pipe will carry steam. Why must support saddles and pipe clamps allow for thermal changes?





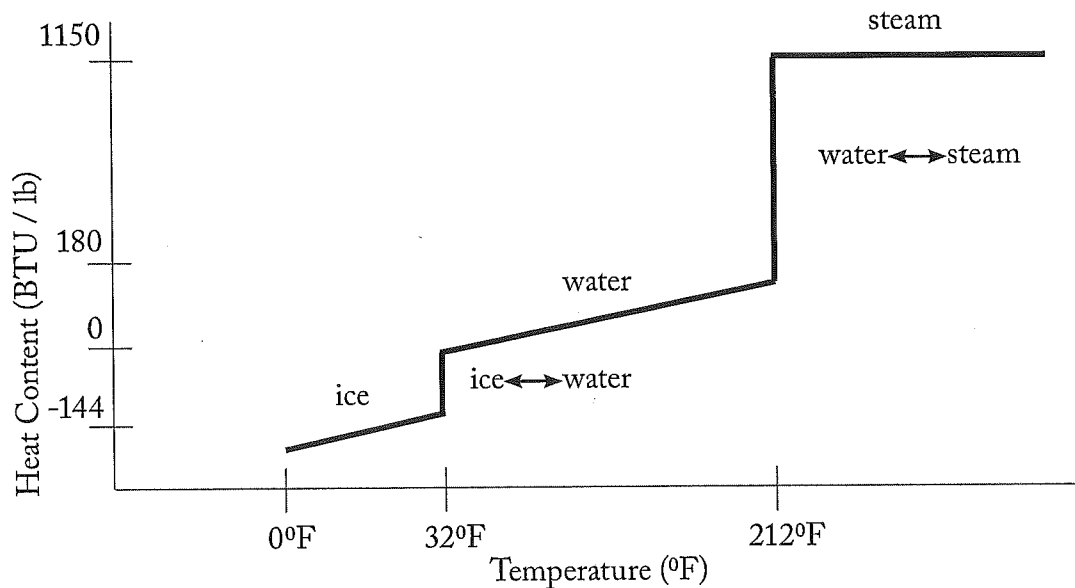
- 8) The line graph shows the heat content of water at various temperatures, at normal atmospheric pressure. A BTU is the amount of heat required to raise the temperature of one pound of water by 1°F.

Heat that can be sensed by a thermometer is called **sensible heat**. When the temperature of a substance increases or decrease, sensible heat has been added or subtracted. When a substance absorbs heat or releases heat while undergoing a change in state but not a change in temperature, the heat causing the change is “hidden”, or **latent heat**.

The heat in transformation between solid and liquid is the latent heat of fusion. The heat in the transformation between liquid and gas is the latent heat of vaporization.

On the line graph, circle and label the parts of the line that show:

- A. Latent heat of vaporization
- B. Latent heat of fusion





Problem Set 1: Clevis Hanger

Workers in the piping trades locate information in tables when selecting sizes of materials. Use the document titles *Clevis Hanger Standard Duty #24Z* to answer the following questions.

- 1) What is the recommended use of clevis hangers?

- 2) What four specifications are required when ordering?

- 3) What happens to the size of the cross bolt as the size of the iron pipe increases?

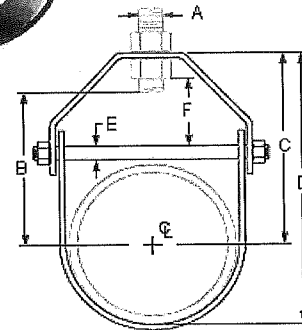
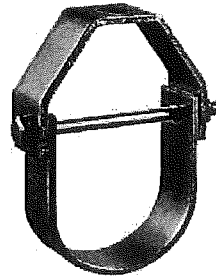
- 4) What is required when pipes larger than 16 inches are installed?

- 5) List two iron pipe sizes for clevis hangers that use a $\frac{1}{2}$ " cross bolt.



CLEVIS HANGER Standard Duty #24Z

- 1/2" through 30"
- Carbon Steel
- Electro-Plated Zinc
- Complies with MSS SP-58 and SP-69 (Type 1).
- cUL Approved (2 1/2" through 8"- Mild Steel & S/S)
FM Approved (3/4" through 8" - Mild Steel Only)
- Recommended for the suspension of non-insulated, stationary pipe lines allowing for vertical adjustment.
- Specify pipe size, figure number, name and finish.
- Also Available in Bare, Hot Dip Galvanized, Stainless Steel, Epoxy



'B'
Rod Take-Out
Pipe center to bottom of hanger rod.
'C'
Pipe center to top of hanger.
'D'
Bottom of pipe to top of hanger



IRON PIPE SIZE	SPECIFICATION DATA							UPPER	LOWER	REC. MAX LOAD (LBS)	APP'X WT. PER 100 PCS.	PCS PER PKG.
	A	B	C	D	E	F						
1/2	3/8	1 1/8	1 11/16	2 1/16	1/4	7/16	13 ga x 7/8	13 ga x 7/8	610	18	100	
3/4	3/8	1 1/8	1 11/16	2 9/16	1/4	7/16	13 ga x 7/8	13 ga x 7/8	610	18	100	
1	3/8	1 5/16	2 1/16	2 11/16	1/4	5/8	13 ga x 7/8	13 ga x 7/8	610	22	100	
1 1/4	3/8	1 5/8	2 1/2	3 3/16	1/4	7/8	13 ga x 7/8	13 ga x 7/8	610	26	100	
1 1/2	3/8	1 7/8	2 7/8	3 11/16	1/4	1 1/16	12 ga x 7/8	12 ga x 7/8	610	34	100	
2	3/8	2 1/4	3 5/16	4 7/16	1/4	1 1/4	12 ga x 7/8	12 ga x 7/8	610	38	50	
2 1/2	1/2	2 7/8	4 1/2	5 7/8	5/16	1 15/16	9 ga x 1 3/16	10 ga x 1 3/16	1130	86	50	
3	1/2	3 5/16	4 3/4	6 1/2	5/16	1 3/4	9 ga x 1 3/16	10 ga x 1 3/16	1130	96	25	
3 1/2	1/2	4 1/32	5 7/8	7 15/16	5/16	2 9/16	8 ga x 1 3/16	10 ga x 1 3/16	1130	114	25	
4	5/8	4 1/8	5 15/16	8 3/16	3/8	2 1/8	8 ga x 1 3/16	10 ga x 1 3/16	1430	126	25	
5	5/8	4 3/16	5 11/16	8 7/16	1/2	1 7/16	4 ga x 1 1/4	8 ga x 1 1/4	1430	204	25	
6	3/4	5 1/16	6 13/16	10 1/8	1/2	1 3/4	3 ga x 1 1/2	8 ga x 1 1/2	1940	280	10	
8	3/4	6 3/16	8 1/16	12 7/16	5/8	1 7/8	3 ga x 1 3/4	8 ga x 1 3/4	2000	446	10	
10	7/8	7 3/4	10	15 7/16	3/4	2 1/4	3/8 x 1 3/4	3 ga x 1 3/4	3600	806	BULK	
12	7/8	9 1/32	11 9/16	18	3/4	2 13/16	3/8 x 2	3 ga x 2	3800	1034	BULK	
14	1	11 1/4	14 3/8	20 1/4	7/8	4 3/8	1/2 x 2	1/4 x 2	4200	1430	BULK	
16	1	11 15/16	13 15/16	21 15/16	1	2 13/16	1/2 x 2 1/2	1/4 x 2 1/2	4600	2100	BULK	
18*	1	13 7/8	16	25	1	3 3/4	1/2 x 2 1/2	1/4 x 2 1/2	4800	2440	BULK	
20*	1 1/4	15 1/8	17 1/2	27 1/2	1 1/4	3 3/4	5/8 x 3	3/8 x 3	4800	4700	BULK	
24*	1 1/4	18 3/8	23 3/4	31 3/4	1 1/4	4	5/8 x 3	3/8 x 3	4800	5800	BULK	
30*	1 1/4	21 1/2	27 3/4	39 5/8	1 1/4	4 3/4	3/4 x 3	3/8 x 3	6000	7500	BULK	

* fitted with pipe spacer on cross bolt.

Oversized Clevis Hanger Installations:

Note: A pipe spacer should be placed over the clevis bolt and blocks need to be placed on either side of the pipe until final installation is completed. Additionally all clevis hangers on the line need to take up their share of the pipe load prior to insulating to prevent hanger damage by overloading.



QWI 4.3.1 Issue Date Mar/12 Rev.14

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Problem Set 2: Pipe Hangers and Supports

Workers in the piping trades install pipe hangers and supports to support piping systems. Pipe hangers anchor and support the load (weight of the pipe, the content of the pipe, pipe fittings, and pipe coverings). Use the document titled *E-1 Pipe Hangers and Supports* to answer the following questions.

- 1) What is recommended maximum spacing for 2 ½ inch steel pipe systems?

- 2) Pipe hangers are placed at the beginning and end of each run of pipe, as well as spaced out throughout the run according to Table #108. Calculate the number of hangers required for a 48 m run of 50 mm copper tube.

- 3) Which pipe material requires the closest maximum spacing for pipe hangers?

- 4) Under what condition can the support rod diameter be safely reduced?

- 5) 12-inch flexible plastic tube is used on a job. The load on the tube is 4000 lbs. What size of rod should be used for continuous support along its length?



500 APPENDICES

E-1 Pipe Hangers and Supports

HANGERS AND SUPPORTS Recommended Maximum Spacing					
Nominal Pipe Size		Steel Pipe Systems		Copper Tubes	
inches	mm	feet	m	feet	m
1/4	8	7	2.1	5	1.5
3/8	10	7	2.1	5	1.5
1/2	15	7	2.1	5	1.5
3/4	20	7	2.1	5	1.5
1	25	7	2.1	6	1.8
1 1/4	32	7	2.1	7	2.1
1 1/2	40	9	2.7	8	2.4
2	50	10	3.4	8	2.4
2 1/2	65	11	3.4	9	2.7
3	80	12	3.7	10	3.0
3 1/2	90	13	4.0	11	3.4
4	100	14	4.3	12	3.7
5	125	16	4.9	13	4.0
6	150	17	5.2	14	4.3
8	200	19	5.8	16	4.9
10	250	20	6.1	16	5.5
12	300	23	7.0	19	5.8
14	350	25	7.6	-	-
16	400	27	8.2	-	-
18	450	28	8.5	-	-
20	500	30	9.1	-	-

Table #108 - Pipe Hangers and Supports

Hanger Spacing For Other Material

Asbestos Cement: as per manufacturer's recommendations.

Cast Iron Pressure Pipe: 12 ft. (3.7 m) maximum.

Cast Iron Soil Pipe: 10 ft. (3.0 m) maximum.
Fiberglass Reinforced Pipe: as per manufacturer's recommendations.

Fiberglass Reinforced Pipe: as per manufacturer's recommendations.

Glass Pipe: 8 ft. (2.4 m) maximum.

Plastic: depends on material and temperature, as per manufacturer's recommendations.

APPENDICES

E-1 Pipe Hangers and Supports

501

Note:

- Extra support or hangers are required when heavy valves or fittings are placed in a piping system, at changes of direction, and/or as per code or job specifications.
- Flexible plastic tube or similar material should be supported continuously.
- Rod diameter may be reduced one size smaller when double rods are used (minimum reduction 3/8 of inch (9.6 mm) (table #109).
- Maximum safe load taken at rod temperature of 610°F (321°C) conforming to ASTM A107 (table #109).

Minimum Rod Sizes					
Nominal Pipe Size		Rod Size		Max. Safe Load	
inches	mm	inches	mm	lbs	kg
2" and smaller	50 and smaller	3/8	9.6	610	276
2 1/2 to 3 1/2	65 to 90	1/2	12.7	1,130	512
4 to 5	100 to 125	5/8	15.8	1,810	821
6	150	3/4	19.1	2,710	1229
8 to 12	200 to 300	7/8	22.2	3,770	1710
14 to 18	350 to 450	1	25.4	4,960	2249
20 to 24	500 to 600	1 1/4	31.8	8,000	3628

Table #109 - Single Rod Diameter



Problem Set 3: BC Plumbing Code – Traps and Interceptors

Workers in the piping trades read and refer ... Use the documents titled *Division B – Part 2 BC Plumbing Code 2012* to answer the following questions.

- 1) What is the minimum trap seal depth on a fixture that drains to an acid waste system?

- 2) Under what condition is the cleanout plug not the same materials as the trap?

- 3) What do asbestos-cement water pipes, concrete pipe and vitrified clay pipe have in common?

- 4) What is the difference between PVC water pipe and CVPC water pipe?

- 5) List the types of relief valves mentioned.

British Columbia Plumbing Code 2012

Division B – Part 2

2.2.3. Traps and Interceptors

2.2.3.1. Traps

- 1) Except as provided for in Sentence (2), every *trap* shall
 - a) have a *trap seal depth* of not less than 38 mm,
 - b) be so designed that failure of the seal walls will cause exterior leakage, and
 - c) have a water seal that does not depend on the action of moving parts.

(See Appendix A.)

- 2) The *trap seal depth* on *fixtures* draining to an acid waste system shall be a minimum of 50 mm.
- 3) <Except for a floor-mounted service sink,> every *trap* that serves a lavatory, a sink or a laundry tray shall
 - a) be provided with a *cleanout* plug located at the lowest point of the *trap* and of the same material as the *trap*, except that a cast-iron *trap* shall be provided with a brass *cleanout* plug, or
 - b) be designed so that part of the *trap* can be removed for cleaning purposes.

(See Appendix A.)

- 4) A bell *trap* shall not be installed in a *drainage system*. (See Appendix A.)
- 5) A drum *trap* shall not be used as a *fixture trap* unless required to serve as an *interceptor* and access for servicing is provided.

2.2.3.2. Interceptors

- 1) Every *interceptor* shall be designed so that it can be readily cleaned.
- 2) Every grease *interceptor* shall
 - a) be designed so that it does not become air bound, and
 - b) not have a water jacket.

2.2.3.3. Tubular Traps

- 1) Tubular metal or plastic *traps* conforming to <ASME A112.18.2/CSA B125.2, "Plumbing Waste Fittings,"> shall be used only in accessible locations.

2.2.4. Pipe Fittings

2.2.4.1. T and Cross Fittings

(See Appendix A.)

- 1) A T fitting shall not be used in a *drainage system*, except to connect a *vent pipe*.
- 2) A cross fitting shall not be used in a *drainage system*.

2.2.4.2. Sanitary T Fittings

(See Appendix A.)

- 1) A single or double sanitary T fitting shall not be used in a *nominally horizontal soil-or-waste pipe*, except that a single sanitary T fitting may be used to connect a *vent pipe*.
- 2) A double sanitary T fitting shall not be used to connect the *trap arms* of
 - a) back outlet water closets installed back-to-back, or
 - b) 2 urinals where no *cleanout* fitting is provided above the connection.

2.2.4.3. 90° Elbows

- 1) Except as permitted in Sentence (2), 90° elbows of 4 inch *size* or less whose centre-line radius is less than the *size* of the pipe shall not be used to join 2 *soil-or-waste pipes*.
- 2) For *sanitary drainage systems* of 4 inch *size* or less, 90° elbows <described in Sentence (1)> shall only be permitted
 - a) to change the direction of piping from horizontal to vertical, in the direction of flow,
 - b) where a *trap arm* enters a wall, or
 - c) to connect *trap arms* as permitted by Sentence 2.5.6.3.(2).

Division B – Part 2
British Columbia Plumbing Code 2012
2.2.5. Non-Metallic Pipe and Fittings

(For a summary of pipe applications, see A-2.2.5., 2.2.6. and 2.2.7. in Appendix A.)

2.2.5.1. Asbestos-Cement Drainage Pipe and Fittings

1) Except as provided in Sentence (2), asbestos-cement pipe and its fittings for use in a drain, waste or vent system shall conform to

- a) CAN/CGSB-34.22, "Asbestos-Cement Drain Pipe," or
- b) CAN/CSA-B127.1, "Asbestos Cement Drain, Waste and Vent Pipe and Pipe Fittings."

 2) Asbestos-cement pipe and its fittings for use in a drain, waste or vent system that are used underground either outside a *building* or under a *building* shall conform to Sentence (1) or to

- a) CAN/CGSB-34.9, "Asbestos-Cement Sewer Pipe,"
- b) CAN/CGSB-34.23, "Asbestos-Cement House Connection Sewer Pipe," or
- c) CSA B127.2-M, "Components for Use in Asbestos Cement Building Sewer Systems."

2.2.5.2. Asbestos-Cement Water Pipe and Fittings

1) Asbestos-cement water pipe, couplings and bends shall conform to CAN/CGSB-34.1, "Asbestos-Cement Pressure Pipe."

2) Asbestos-cement water pipe shall not be used above ground.

2.2.5.3. Concrete Pipe and Fittings

1) Concrete pipe shall conform to

- a) CAN/CSA-A257.1, "Non-Reinforced Circular Concrete Culvert, Storm Drain, Sewer Pipe, and Fittings," or
- b) CAN/CSA-A257.2, "Reinforced Circular Concrete Culvert, Storm Drain, Sewer Pipe, and Fittings."

2) Joints with internal elastomeric gaskets shall conform to CAN/CSA-A257.3, "Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections, and Fittings Using Rubber Gaskets."

3) Concrete fittings fabricated on the site from lengths of pipe shall not be used. (See Appendix A.)

 4) Concrete pipe shall not be used above ground inside a *building*.

5) Precast reinforced circular concrete manhole sections, catch basins and fittings shall conform to CAN/CSA-A257.4, "Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings."

2.2.5.4. Vitrified Clay Pipe and Fittings

1) Vitrified clay pipe and fittings shall conform to CSA A60.1-M, "Vitrified Clay Pipe."

2) Couplings and joints for vitrified clay pipe shall conform to CSA A60.3-M, "Vitrified Clay Pipe Joints."

 3) Vitrified clay pipe and fittings shall not be used except for an underground part of a *drainage system*.

2.2.5.5. Polyethylene Pipe and Fittings

1) Polyethylene water pipe, tubing and fittings shall conform to Series 160 of CAN/CSA-B137.1, "Polyethylene (PE) Pipe, Tubing, and Fittings for Cold-Water Pressure Services."

 2) Polyethylene water pipe shall not be used except for a *water service pipe*.

3) Butt fusion fittings for polyethylene pipe shall conform to ASTM D 3261, "Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing."

2.2.5.6. Polyethylene Pipe Used Underground

 1) Polyethylene pipe used underground outside a *building* for the rehabilitation of existing *drainage systems* using trenchless technology shall conform to ASTM F 714, "Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter," and shall be HDPE 3408 and SDR 11 or heavier. (See Appendix A.)

2.2.5.7. Crosslinked Polyethylene Pipe and Fittings

 1) Crosslinked polyethylene pipe and its associated fittings used in hot and cold *potable water systems* shall conform to CAN/CSA-B137.5, "Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications." (See Appendix A.)

2.2.5.8. PVC Pipe and Fittings

1) PVC water pipe, fittings and solvent cement shall

- a) conform to CAN/CSA-B137.3, "Rigid Polyvinylchloride (PVC) Pipe and Fittings for Pressure Applications," and
- b) have a pressure rating of not less than 1 100 kPa.



British Columbia Plumbing Code 2012

Division B – Part 2

- 2) PVC water pipe fittings shall conform to
 - a) ASTM D 2466, "Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40," or
 - b) ASTM D 2467, "Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80."

3) **PVC injection-moulded gasketed fittings shall conform to CAN/CSA-B137.2, "Polyvinylchloride (PVC) Injection-Moulded Gasketed Fittings for Pressure Applications."**

- 4) PVC water pipe and fittings referred to in Sentences (1), (2) and (3) shall not be used in a hot water system.

2.2.5.9. CPVC Pipe, Fittings and Solvent Cements

- 1) CPVC hot and cold water pipe, fittings and solvent cements shall conform to CAN/CSA-B137.6, "Chlorinated Polyvinylchloride (CPVC) Pipe, Tubing, and Fittings for Hot- and Cold-Water Distribution Systems."
- 2) The design temperature and design pressure of a CPVC piping system shall conform to Table 2.2.5.9.

Table 2.2.5.9.
Maximum Permitted Pressure for CPVC Piping at Various Temperatures
 Forming part of Sentence 2.2.5.9.(2)

Maximum Temperature of Water, °C	Maximum Permitted Pressures, kPa
10	3 150
20	2 900
30	2 500
40	2 100
50	1 700
60	1 300
70	1 000
80	700
90	500
100	400

2.2.5.10. Plastic Pipe, Fittings and Solvent Cement Used Underground

(See A-2.2.5.10. to 2.2.5.12. in Appendix A.)

- 1) Plastic pipe, fittings and solvent cement used underground outside a building or under a building in a drainage system shall conform to
 - a) ASTM F 628, "Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core,"
 - b) CAN/CSA-B181.1, "Acrylonitrile-Butadiene-Styrene (ABS) Drain, Waste, and Vent Pipe and Pipe Fittings,"
 - c) CAN/CSA-B181.2, "Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings,"
 - d) CAN/CSA-B182.1, "Plastic Drain and Sewer Pipe and Pipe Fittings," with a pipe stiffness not less than 320 kPa,
 - e) CAN/CSA-B182.2, "PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings," with a pipe stiffness not less than 320 kPa,
 - f) CAN/CSA-B182.4, "Profile Polyvinylchloride (PVC) Sewer Pipe and Fittings," with a pipe stiffness not less than 320 kPa, or
 - g) CAN/CSA-B182.6, "Profile Polyethylene (PE) Sewer Pipe and Fittings For Leak-Proof Sewer Applications," with a pipe stiffness of not less than 320 kPa.

2.2.5.11. Transition Solvent Cement

(See A-2.2.5.10. to 2.2.5.12. in Appendix A.)

- 1) Solvent cement for transition joints shall conform to
 - a) CAN/CSA-B181.1, "Acrylonitrile-Butadiene-Styrene (ABS) Drain, Waste, and Vent Pipe and Pipe Fittings," or
 - b) CAN/CSA-B181.2, "Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings."
- 2) Transition solvent cement shall only be used for joining an ABS drainage system to a PVC drainage system.



Problem Set 4: Base Mounted Pump

Workers in the piping trades follow manufacturer install and operation instructions. Use the document titled Installation & Operating Instructions Series 4030 Base Mounted Pump to answer the following questions.

- 1) What must a worker do to make sure the equipment is guaranteed after installment?

- 2) List four problems that result from misalignment.

- 3) A bump test shows the three-phase motor is rotating counter clockwise. Explain what a worker should do before starting the pump.

- 4) When performing general inspection of a base mounted pump without mechanical seal environmental accessories, what should the worker look for?

- 7) Why is lubrication of pump bearings not required?

- 8) When changing the oil in oil-lubricated bearings, what needs to be done before refilling an empty bearing bracket with clean oil?

INSTALLATION &
OPERATING INSTRUCTIONS

Series 4030
Base mounted pump

6

6.0 ALIGNMENT

The pumping unit is accurately aligned at the factory prior to being shipped. All baseplates are flexible to some extent and should not be relied upon to maintain factory alignment.

Realignment is necessary as follows:

- A After the unit has been set level on the foundation.
- B After the grout has set and the foundation bolts final tighten.
- C After the pipes have been connected.

Accurate alignment is absolutely essential. Proper mechanical operation of the equipment cannot be guaranteed unless the factory alignment is reproduced in the field. All alignment should be made by moving or shimming the motor.

The below instructions should be following to put back the coupling during the alignment process:

- Mount the hubs on the shaft of driving and driven side (see FIG 1.).
- Insert the spider or DZ elements into the cam section of the hub on the driving or driven side.
- Shift the power packs in axial direction until the distance dimension ϵ is achieved (see FIG 2).
- Shift the hubs axially on the shaft to adjust the dimension ϵ to values shown in TABLE 1.
- Fasten the hubs by tightening the setscrews DIN EN ISO 4029 with a cup point (tightening torques see TABLE 1).

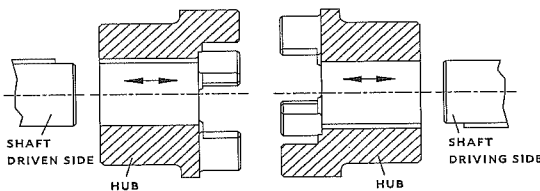


FIG 1: ASSEMBLY OF THE HUBS

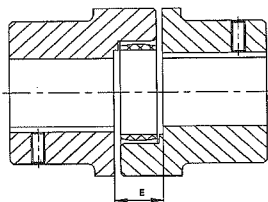


FIG 2: ASSEMBLY OF COUPLING

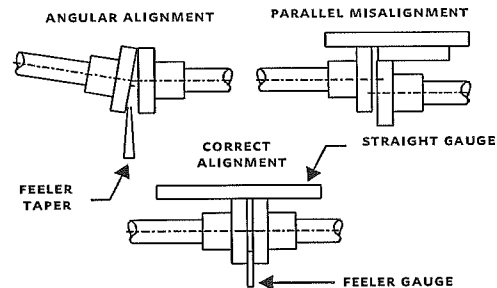
TABLE 1: Coupling installation

Size	Tightening torque TA Nm (ft.lbs)	Dimension ϵ mm (inch)
14	1.5 (1.1)	13 (0.51)
19	2 (1.5)	16 (0.63)
24	2 (1.5)	18 (0.71)
28	10 (7.4)	20 (0.79)
38	10 (7.4)	24 (0.94)
42	10 (7.4)	26 (1.02)
48	10 (7.4)	28 (1.10)
55	17 (12.5)	30 (1.18)
65	17 (12.5)	35 (1.38)
75	17 (12.5)	40 (1.57)
90	40 (29.5)	42 (1.65)
100	40 (29.5)	50 (1.97)
110	80 (59.0)	55 (2.17)
125	80 (59.0)	60 (2.36)
140	140 (103.3)	65 (2.56)
160	140 (103.3)	75 (2.95)
180	140 (103.3)	85 (3.35)

The flexible coupling compensates for temperature changes and permits end movement of shafts without them interfering with each other; it will not compensate for misalignment. Faulty alignment will result in noisy pump operation, reduced bearing life, excessive coupling wear and wasted power.

To verify alignment, place a straight edge across the coupling as shown in the following illustration; this must rest evenly on both rims at top, bottom and both sides.

With a pair of inside calipers or thickness gauge, check distance between coupling halves at points where straight edge



was used; distance must be equal at all points.

TESTING ALIGNMENT

CAUTION

Be sure to reinstall any temporarily removed coupling guards, prior to starting the pumping unit.

OPERATION - SERIES 4030 BASE MOUNTED PUMP**7.0 STARTING PUMP**

The pump must be fully primed on start up. Fill the pump casing with liquid and rotate the shaft by hand to remove any air trapped in the impeller. Air trapped in the casing is automatically vented through the top centre line discharge.

When the piping is connected correctly and the final alignment completed, re-connect the coupling and reinstall the coupling guard.

'Bump' or energize the motor for a fraction of a second and check that the rotation corresponds with the directional arrow on the pump casing.

To reverse rotation of a three phase motor, interchange any two power leads.

Start the pump with the discharge valve closed and the suction valve open, then gradually open the discharge valve when the motor is at operating speed. The discharge valve may be 'cracked' or open slightly at start up to help eliminate trapped air.

When stopping the pump: Close the discharge valve and de-energize the motor.

CAUTION

Centrifugal pump rotation is generally 'clockwise' when viewing from the drive end.

Check rotation arrow prior to operating the unit.

8.0 GENERAL CARE

Base Mounted pumps are built to operate without periodic maintenance with the exception of lubrication of motor bearings, if required. A systematic inspection made at regular intervals, giving special attention to the following, will ensure years of trouble-free operation.

Keep unit clean.

Provide the motor with correctly sized overload protection.

Keep moisture, refuse, dust or other loose particles away from the pump and ventilating openings of the motor.

Avoid operating the unit in overheated surroundings. Generally (Above 100°F(40°C)).

If mechanical seal environmental accessories are installed, ensure water is flowing through the sight flow indicator and that filter cartridges are replaced as recommended.

WARNING

Whenever any service work is to be performed on pumping unit, disconnect power source to driver.

Any possibility of the unit starting while being worked on, must be eliminated.

9.0 LUBRICATION**Pump**

Series 4030 pumps are supplied, as standard, with maintenance free, sealed for life, grease lubricated bearings. Site regreasing is not required.

If re-greasable bearing were ordered: Grease lubricated bearings require very little attention. More trouble can be caused by overcharging than undercharging with grease.

Approximately every four months, inject a small quantity of grease (while the pump is running) EXXON MP type H or equal lithium based petroleum grease as follows:

- A Remove relief hole plug.
- B Inject grease at grease fitting.
- C Fill until new grease is visible at relief hole.

If Oil lubricated bearings were ordered: Use non-detergent iso viscosity grade 150 oil, similar to Teresso/Teresstic 150 or Morlina/Tellus 150. Before start-up, check to make sure the oil level is within 0.125" (3mm) of the top of the oil sight glass. Under normal operating conditions, the oil should be changed every six months as follows:

- A Drain the old oil from the bearing bracket through the drain hole at the bottom of the housing.
- B Thoroughly flush the bearing bracket with kerosene.
- C Refill the clean oil through the vent on the top of the bracket until the oil level reaches within 0.125" (3mm) of the top of the oil sight glass.





Problem Set 5: Blueshield MSDS Air Liquide

Workers in the piping trades often work with or around hazardous materials. Material Safety Data Sheets (MSDS) and Safety Data Sheets (SDS) provide specific information about hazards, safe handling and emergency procedures for hazardous materials. MSDSs and SDSs must be available to workers. Use the documents titled *Material Safety Data Sheet Acetylene* and *GHS Pictograms and Hazards* to answer the following questions.

- 1) Which section has information about what to do if a worker inhales the fumes?

- 2) Which hazard symbols should be included on a workplace label?

- 3) List two engineering controls that help keep worker exposure below recommended limits.

- 4) A worker's eyes have come in contact with welding fumes from this product. What should be done before getting medical help?

- 5) List the required PPE for a worker working in a well-ventilated area.



Material Safety Data Sheet - MSDS

Section 1. Chemical Product and Company Identification

Product name Blueshield	Classification CSA:	Classification AWS:
620-308L;	E308L-17;	E308L-17;
620P-308L;	E308L-17;	E308L-17;
622-316L;	E316L-17;	E316L-17;
622P-316L;	E316L-17;	E316L-17;
624-309L;	E309L-17;	E309L-17;
624P-309L	E309L-17;	E309L-17;
Description	: SMAW Stainless Consumables	Generic Code : AL-T-011-0
In case of emergency	: 1-514-878-1667	Date of issue : 01/13/2014
Supplier	: Air Liquide Canada Inc., 1250, René-Lévesque Ouest, Suite 1700, Montréal, QC H3B 5E6	

Section 2. Hazards Identification

Physical state and Appearance : Solid.

Emergency overview : These hazards relate to welding fumes (electrodes in use) and not to the electrodes as sold.

WARNING!
ELECTRIC SHOCK can kill.
FUMES AND GASES can be dangerous to your health.
ARC RAYS can injure eyes and burn skin.
MAY BE HARMFUL IF INHALED. CAUSES RESPIRATORY TRACT, EYE AND SKIN IRRITATION. MAY CAUSE ALLERGIC SKIN REACTION. CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
CANCER HAZARD - CONTAINS MATERIAL WHICH CAN CAUSE CANCER.
Do not handle until all safety precautions have been read and understood. Obtain special instructions before use. Use only with adequate ventilation. Do not eat, drink or smoke when using this product. Avoid contact with eyes, skin and clothing. Keep container tightly closed. Use personal protective equipment as required. Wash thoroughly after handling.

Routes of entry : Dermal contact. Eye contact. Inhalation.

Potential acute health effects

Eyes : Very hazardous by the following route of exposure: of eye contact (irritant). Inflammation of the eye is characterized by redness, watering and itching.

Skin : Hazardous by the following route of exposure: of skin contact (corrosive, irritant, sensitizer). Skin contact may produce burns. Skin inflammation is characterized by itching, scaling, reddening or, occasionally, blistering.

Inhalation : Hazardous by the following route of exposure: of inhalation (lung irritant).

Ingestion : Since the product (welding fumes) is a gas and that it is mostly probable that it will be inhaled more than ingested, please consider first to look at the preventive measures in case of inhalation.

Potential chronic health effects :

Carcinogenicity

Product/ingredient name	ACGIH	OSHA	IARC	NTP	EU
Titanium dioxide	A4	-	2B	-	Carc. 2, H351
Crystalline silica respirable	A2	-	1	Known to be a human carcinogen.	Carc. 1A, H350
nickel	A5	-	2B	Reasonably anticipated to be a human carcinogen.	Carc. 2, H351
Calcium fluoride	A4	-	3	-	-

Mutagenic effects Not available.
Teratogenic effects: Not available.

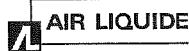
Medical conditions aggravated by over-exposure : Pre-existing skin disorders and disorders involving any other target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

(* See Abbreviations (section 16).)

Section 3. Composition, Information on Ingredients

Name	CAS #	% by weight	UN number
Iron	7439-89-6	0.01 - 67.5	Not available.
Titanium dioxide	13463-67-7	20 - 34	Not available.
Chromium	7440-47-3	10 - 23.5	Not available.
Crystalline silica respirable	14808-60-7	9 - 18	Not available.
Calcium carbonate	471-34-1	6 - 10	Not available.
Aluminium oxide	1344-28-1	4 - 10	Not available.
Nickel	7440-02-0	0.01 - 11.2	Not available.
Calcium fluoride	7789-75-5	2 - 4	Not available.
Dipotassium oxide	12136-45-7	1.5 - 3.5	UN2033
Manganese	7439-96-5	0.5 - 2.5	Not available.
Molybdenum	7439-98-7	0.01 - 2.75	Not regulated.

1-800-817-7697
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The fumes emitted by the electrodes, in use, are hazardous. This MSDS is written for workers using these electrodes.
See Section 8 for Exposure Limits of the oxides found in the welding fumes.

Section 4. First Aid Measures

- Eye contact** : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.
- Skin contact** : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.
- Inhalation** : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.
- Ingestion** : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Section 5. Fire Fighting Measures

- Flammability of the product** : Non-flammable. Emits toxic fumes when heated.
- Explosibility** : Non-explosive in the presence of the following materials or conditions: open flames, sparks and static discharge, heat and shocks and mechanical impacts.
- Fire-fighting media and instructions** : Use an extinguishing agent suitable for the surrounding fire.

Section 6. Accidental Release Measures

- Small/Large Spill and Leak** : Use appropriate tools to transfer the spilled solid to a convenient waste disposal container. If necessary: **Neutralize the residue with a dilute solution of acetic acid.** Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Section 7. Handling and Storage

- Handling** : Avoid contact with eyes. Avoid breathing dust. Avoid prolonged or repeated contact with skin. Do not get on skin or clothing. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Avoid contact of spilled material and runoff with soil and surface waterways.
- Storage** : All filler metals in their original, unopened containers should be kept in a relatively dry storage area at temperatures between 15°C (60°F) and 30°C (80°F) and 50% maximum relative humidity.

Section 8. Exposure Controls, Personal Protection

- Engineering controls** : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.
- Personal protection**
 - Eyes** : Safety glasses with side shields. Face shield with radiation shielding.
 - Body** : Full suit. Fire resistant.
 - Respiratory** : Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear a canister breathing apparatus (respirator) or a supplied-air respirator, when required, to weld in a confined space or when room exhaust or ventilation does not keep exposure below the acceptable values.
 - Hands** : Gloves. Fire resistant.
 - Feet** : Metal cap, safety boots.

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			Notations
Ingredient	List name	ppm	mg/m³	Other	ppm	mg/m³	Other	ppm	mg/m³	Other	
Titanium dioxide	US ACGIH 6/2013	-	10	-	-	-	-	-	-	-	[a] [b] [c] [d]
	AB 4/2009	-	10	-	-	-	-	-	-	-	
	BC 7/2013	-	3	-	-	-	-	-	-	-	
	ON 1/2013	-	10	-	-	-	-	-	-	-	
Chromium, measured as Cr	QC 12/2012	-	10	-	-	-	-	-	-	-	[e] [3]
	US ACGIH 6/2013	-	0.5	-	-	-	-	-	-	-	
	AB 4/2009	-	0.5	-	-	-	-	-	-	-	
	BC 7/2013	-	0.5	-	-	-	-	-	-	-	
Chromium, as Cr	ON 1/2013	-	0.5	-	-	-	-	-	-	-	[e]
	QC 12/2012	-	0.5	-	-	-	-	-	-	-	
	US ACGIH 6/2013	-	0.025	-	-	-	-	-	-	-	
	AB 4/2009	-	0.025	-	-	-	-	-	-	-	
Crystalline silica respirable	BC 7/2013	-	0.025	-	-	-	-	-	-	-	[f] [g] [h] [i]
	ON 1/2013	-	0.1	-	-	-	-	-	-	-	
	QC 12/2012	-	0.1	-	-	-	-	-	-	-	
	US ACGIH 6/2013	-	1	-	-	-	-	-	-	-	
Aluminium oxide	AB 4/2009	-	10	-	-	-	-	-	-	-	[f] [g] [h] [i]
	BC 7/2013	-	1	-	-	-	-	-	-	-	
	ON 1/2013	-	1	-	-	-	-	-	-	-	
	QC 12/2012	-	10	-	-	-	-	-	-	-	
Aluminium oxide, as Al	ON 1/2013	-	1	-	-	-	-	-	-	-	[f] [d]
	QC 12/2012	-	10	-	-	-	-	-	-	-	

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Globally Harmonized System

GHS Pictograms and Hazards

Flame



- Flammable
- Self-Reactive
- Pyrophoric
- Self-Heating
- In Contact with Water, Emits Flammable Gases
- Organic Peroxide

Exclamation Mark



- Irritation (skin or eyes)
- Skin Sensitization
- Acute Toxicity (harmful)
- Specific Target Organ Toxicity – Single Exposure (drowsiness or dizziness, or respiratory irritation)
- Hazardous to the Ozone Layer

Health Hazard



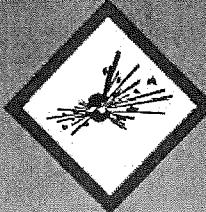
- Carcinogenicity
- Respiratory Sensitization
- Reproductive Toxicity
- Specific Target Organ Toxicity – Single or Repeated Exposure
- Germ Cell Mutagenicity
- Aspiration Hazard

Skull & Crossbones



- Acute Toxicity (fatal or toxic)

Exploding Bomb



- Explosive
- Self-Reactive (severe)
- Organic Peroxide (severe)

Flame Over Circle



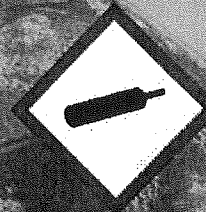
- Oxidizer

Corrosion



- Corrosive (skin, eyes, or metals)

Gas Cylinder



- Gas Under Pressure

Environment



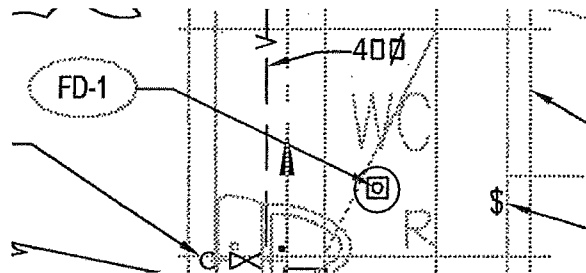
- Hazardous to the Aquatic Environment (acute or long-term)

Problem Set 6: Washroom Layout

Workers in the construction industry often work around hazardous materials such as asbestos. They need to follow safety procedures.

Use the document *Alberta Asbestos Abatement Manual* to answer the following questions.

- 1) What is the toilet seat model number for the WC shown in the Washroom Layout?
- 2) How many litres of water are used per flush (LPF) for the toilet shown in the Washroom Layout?
- 3) Circle the location of the exhaust fan switch.
- 4) What does this symbol indicate?



- 5) List the three sizes of pipes that are plumbed to the sink.
- 6) What are the differences between the seat models used for WC-1 and an WC-2?
- 7) How many pipe drops are shown in the drawing?

PLUMBING FIXTURE SCHEDULE

WC-1 TOILET - FLOOR MOUNTED BARRIER FREE FLUSH VALVE

American Standard 'MADERA ELONGATED' 16-1/2" (419mm) HIGH #2305.100 "top spud, 13LPF water saver", floor mounted, vitreous china, elongated bowl, fully glazed trap way, syphon jet action - 1-1/2" top spud bolt caps - for use with flush valve. Provide Sloan flush valve model 111-ES-S-YO-"G2 OPTIMA PLUS" C.P. exposed diaphragm type, no-touch electronic hard wired flush valve, non-hold open feature, back-check angle stop, V.P. trim, vacuum breaker, A.D.A. oscillating lever handle, 6LPF low consumption, angle stop extended seat bumper. Provide floor flange, flange bolts and gasket. Centoco #820STS heavy duty open front Seat with cover, reinforced concealed stainless steel check hinge, posts, and nuts for elongated bowl.

WC-2 TOILET - FLOOR MOUNTED FLUSH VALVE

American Standard 'MADERA ELONGATED' 16-1/2" (419mm) HIGH #2234.015 "top spud, 6LPF low consumption", floor mounted, vitreous china, elongated bowl, fully glazed trap way, syphon jet action - 1-1/2" top spud bolt caps - for use with flush valve. Provide Sloan flush valve model 111-ES-S-YO-"G2 OPTIMA PLUS" C.P. exposed diaphragm type, no-touch electronic hard wired flush valve, non-hold open feature, back-check angle stop, V.P. trim, vacuum breaker, A.D.A. oscillating lever handle, 6LPF low consumption. Provide floor flange, flange bolts and gasket. Centoco #500STSCC heavy duty open front Seat less cover, reinforced concealed stainless steel check hinge, posts, and nuts for elongated bowl.

L-1 BASIN - WALL MOUNTED (BARRIER FREE DESIGN)

American Standard 'MURRO' #0955.900 Basin, #0059.020 Semi-China Pedestal, 21"x22"x5 to 7-1/2" deep, wall hung basin, vitreous china, rear overflow, with mounting kit. American Standard 'COLONY SOFT' #2275.505.002 Faucet, C.P. 4" (102mm) C.C., lead-free cast brass waterways body, ceramic disc valve cartridges, with 1.84 GPM (8L) flow aerator outlet and metal lever handles. McGuire #155WC Drain, C.P. metal offset open grid. C.P. short horizontal supplies with angle stops, escutcheons, and braided flexible metal risers. McGuire #8872C-17T 'p' Trap, C.P. 17 gauge (1.5mm), 1-1/4" (32mm) and escutcheon. McGuire 'PROWRAP' #PW2000WC Sanitary Covering to exposed piping as per local codes.

SK-1 ONE COMPARTMENT S.S. SINK

Kindred 'STEEL QUEEN' #QSL-2020-8 S.S. Sink, 3 hole, 8" (203mm) centres, 20-1/2"x 20" x 8" (521mm x 500mm x 203mm) deep, counter mounted, back ledge, grade 18-8 type 302 stainless steel, single compartment, back ledge, mirror finished rim, satin finished bowl, self rimming, with crumb cup strainer and sound deadening. Chicago Faucets model 1100-V-XK C.P. 8" C.C., deck mounted, lead free waterways, deck plate, ceramic drip free disc valve cartridge, cast brass swing spout with vandal-resistant 1.84 GPM (8L) flow aerator outlet and hooded cast brass lever handles. Supplies with angle stops, escutcheons, and flexible metal risers. Cast Brass 'p' Trap, 1-1/2" (38mm) with cleanout, unions and escutcheon.

SK-2 TWO COMPARTMENT S.S. SINK

Kindred 'STEEL QUEEN' #QDL-2031-8 S.S. Sink, 3 hole, 8" (203mm) centres, 20-1/2"x 31-1/4" x 8" (521mm x 794mm x 203mm) deep, counter mounted, back ledge, grade 18-8 type 302 stainless steel, double compartment, back ledge, mirror finished rim, satin finished bowl, self rimming, with crumb cup strainers and sound deadening. American Standard #4175.500.002 "Colony Soft", C.P. 8" C.C., deck mounted, lead free waterways, deck plate, ceramic drip free disc valve cartridge, brass swing spout with vandal-resistant 1.84 GPM (8L) flow aerator outlet and single control metal lever handle. Supplies with angle stops, escutcheons, and flexible metal risers. T Cast Brass 'p' Trap, 1-1/2" (38mm) with cleanout, unions and escutcheon.

FD-1 FLOOR DRAINS - FINISHED AREAS

Smith Series 2005ASS Floor Drain, all duco coated cast iron body, reversible flashing clamp with seepage openings and adjustable 5" (127mm) diameter stainless steel 1/4" (6.35mm) thick strainer, secured with S.S. screws, 4" (100mm) throat on strainer. (Where required by local code provide trap primer connection 'P'.)

FD-2 FLOOR DRAINS WITH COMBINATION FUNNEL- MECHANICAL ROOMS & UNFINISHED AREAS (WAREHOUSE

MECHANICAL AND SPRINKLER ROOM) Smith Series 2320-3591 Funnel Floor Drain, all duco coated cast iron body, flashing clamp with seepage openings and adjustable 8-1/2" (216mm) diameter C.I. grate with 4" x 9" (101.6mm x 228.6mm) oval funnel. (Where required by local code provide trap primer connection 'P'.)

PIPING LEGEND		HVAC LEGEND	
SANITARY DRAIN	SAN	NEW SUPPLY DIFFUSER	
SANITARY DRAIN - BURIED	SAN	NEW RETURN AIR GRILLE	
STORM DRAIN	STW	NEW EXHAUST AIR GRILLE	
STORM DRAIN - BURIED	STW	EXISTING SUPPLY DIFFUSER	
SUBSOIL DRAIN	X	EXISTING RETURN AIR GRILLE	
VENT PIPE	V	EXISTING EXHAUST AIR GRILLE	
COLD WATER		SUPPLY DUCT (UP & DOWN)	
HOT WATER		RETURN DUCT (UP & DOWN)	
HOT WATER RECIRC.		EXHAUST DUCT (UP & DOWN)	
INDIRECT DRAIN	D	Q.A. DUCT (UP & DOWN)	
GAS LINE	G	ROUND DUCT (UP & DOWN)	
EXISTING SANITARY	SAN	BALANCING DAMPER	
EXISTING SANITARY - BURIED	SAN	VAV BOX	
EXISTING STORM DRAIN	STW	SUPPLY OUTLET	
EXISTING STORM - BURIED	STW	RETURN OR EXHAUST INLET	
EXISTING VENT	V	DOOR GRILLE - UNDERCUT	
EXISTING COLD WATER		TURNING VANES	
EXISTING HOT WATER		ACOUSTIC LINED DUCTWORK	
EXISTING HOT WATER RECIRC.		NEW DUCT	
EXISTING INDIRECT DRAIN	D	EXISTING DUCTWORK	
EXISTING GAS	G	DUCTWORK TO BE DEMOED	
CLEANOUT		FLEXIBLE DUCT NEW / EXIST.	
FLOOR DRAIN & FD ABOVE		MOTORIZED DAMPER (2 POSITION)	
ROOF DRAIN & RD ABOVE		FIRE DAMPER HORIZ./VERT.	
HUB DRAIN & HD ABOVE		CEILING ACCESS PANEL	
HOSE BIBB		AIR OUTLET OR INLET	
PLUMBING FIXTURE TAG		EQUIPMENT TAG	
PIPE RISE, DROP, TEE DROP		THERMOSTAT	
SHUT-OFF VALVE		EXISTING THERMOSTAT	
THERMOMETER		REMOVED OR RELOCATED TSTAT	
UNION		RELOCATED THERMOSTAT	
CAP OFF		HUMIDISTAT	
NEW PUMP		REVISION TAG	
EXISTING PUMP		SWITCH	
PIPE BREAK			

SPRINKLER LEGEND

NEW SPRINKLER HEAD	●
UPRIGHT SPRINKLER	○
EXISTING SPRINKLER	○
REMOVE OR RELOCATE SPRINKLER-	⊗
RELOCATED SPRINKLER	⊙
NEW SIDEWALL SPRINKLER	▼
EXISTING SIDEWALL SPRINKLER-	▽
NEW DRY SIDEWALL SPRINKLER-	▽
ZONE CONTROL VALVE	ZCV#??
SPRINKLER ALARM VALVE	⊠
SPRINKLER SUPPLY - WET	SPR
FIRE PROTECTION SUPPLY	F
FIRE HOSE CABINET	■
C/W 100' OF 1-1/2" HOSE & FIRE EXTINGUISHER	■
FIRE EXT. W/ WALL BRACKET, -	⊞
& FIRE EXT. WITH RECESSED WALL CABINET	⊞
FLUSH JNT SIAMESE	⊥
SPRINKLER SUPPLY - DRY	DRY
FIRE HYDRANT	⊕

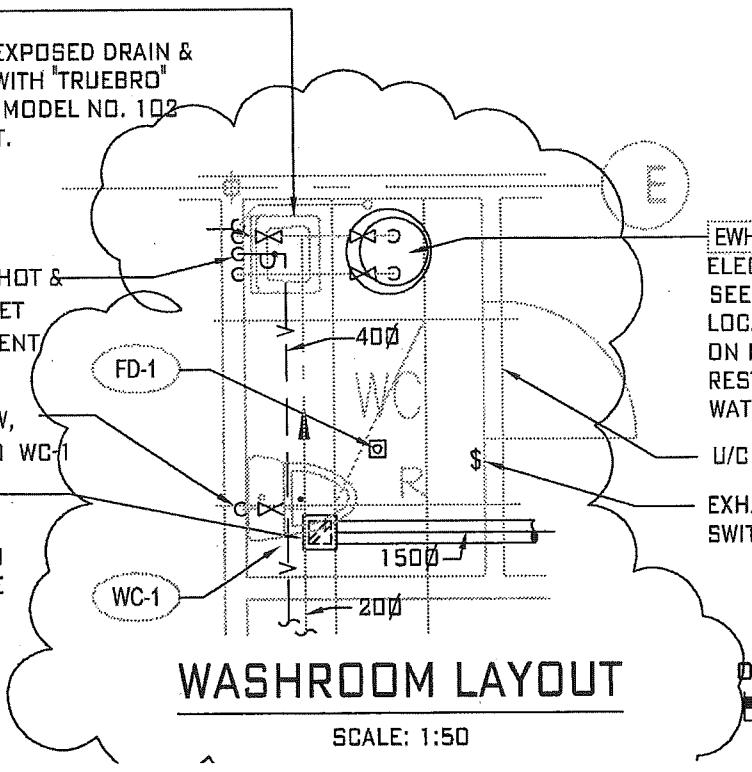
LV-1

INSULATE ALL EXPOSED DRAIN & WATER PIPING WITH "TRUEBRO" LAV GUARD KIT MODEL NO. 102 OR EQUIVALENT.

12MM VALVED HOT & CW, 50Ø OFFSET WASTE, 40Ø VENT

12Ø VALVED CW, 75Ø WASTE TO WC-1

EF-17
EXHAUST FAN SUSPENDED IN CEILING SPACE



EWH-1
ELECTRIC HOT WATER HEATER. SEE DETAIL ON DWG M-5. LOCATE TANK ABOVE CEILING ON PLATFORM c/w SEISMIC RESTRAINTS AND GALVANIZED WATER TIGHT DRAIN PAN.

U/C DOOR 20MM

EXHAUST FAN WIRED TO LIGHT SWITCH BY DIVISION 16.

