ENGINEERING STANDARD

FOR

PROCESS DESIGN OF STEAM TRAPS

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0. INTRODUCTION

"Process Design of Valves and Control Valves, Measurement Devices, and Steam Traps" are broad and contain variable subjects of paramount importance. Therefore, a group of process engineering standards are prepared to cover the subject.

This group includes the following Standard:

STANDARD CODE	STANDARD TITLE
IPS-E-PR-830, Parts One & Two	"Process Design of Valves and Control Valves"
IPS-E-PR-835	"Process Design of Measurement Devices"
IPS-E-PR-845	"Process Design of Steam Traps"

This Engineering Standard covers:

"PROCESS DESIGN OF STEAM TRAPS"

1. SCOPE

This Standard is intended to cover minimum requirements and guidelines for process engineers to specify proper type and prepare data sheet for steam traps. (A typical steam traps data sheet is shown in Appendix A). It should be noted that this Standard does not do away with the need for engineering judgement. It contains basic reference information, data and criteria for steam trap selection as mentioned above.

2. REFERENCES

Throughout this Standard the following Standards and codes are referred to. The editions of these Standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in Standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and Vendor/Consultant.

ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE) / ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

PTC 39.1, "Performance Test Codes for Condensate Removal Devices for Steam Systems"

ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE) / FCI (FLUID CONTROLS INSTITUTE)

69-1, "Pressure Rating Standards for Steam Traps"
85-1, "Standards for Production and Performance Tests for Steam Traps"

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-E-PR-420 "Process Design of Heat Tracing & Winterizing"

3. DEFINITIONS AND TERMINOLOGY

3.1 Company/Employer/Owner

Refers to one of the related affiliated companies of the petroleum industries of Iran such as National Iranian Oil Company (NIOC), National Iranian Gas Company (NIGC), National Petrochemical Company (NPC). etc. as parts of the Ministry of Petroleum.

4. SYMBOLS AND ABBREVIATIONS

BP	=	Balanced Pressure
BM	=	Bimetal
DN	=	Diameter Nominal, (mm)
FCI	=	Fluid Controls Institute
F&T	=	Float and Thermostatic
IB	=	Inverted Bucket
NPS	=	Nominal Pipe Size, in (inch)
TD	=	Thermodynamic
TS	=	Thermostatic.

5. UNITS

This Standard is based on International System of Units (SI), except where otherwise specified.

6. GENERAL

6.1 Typs of Traps

Most steam traps used in the chemical process industries fall into one of three basic categories:

Mechanical traps, which use the density difference between steam and condensate to detect the presence of condensate. This category includes float-and-thermostatic traps and inverted bucket traps. Thermostatic traps, which operate on the principle that saturated process steam is hotter than either its condensate or steam mixed with condensible gas. When separated from steam, condensate cools to below the steam temperature. A thermostatic trap opens its valve to discharge condensate when it detects this lower temperature. This category of trap includes balanced pressure and bimetal traps as well as wax or liquid expansion thermostatic traps. Thermodynamic traps, which use velocity and pressure of flash steam to operate the condensate discharge valve.

6.2 Operating Characteristics and Suggested Applications

The key to trap selection is understanding the application requirements and the characteristics of the steam and knowing which traps meet those requirements while handling the steam conditions. Table 1 summarizes the operating characteristics and suggested applications for each type of trap.

TABLE 1 - COMPARISON TABLE TO BE USED TO IDENTIFY WHICH STEAM TRAP TO CONSIDER FOR A PARTICULAR APPLICATION

TYPE OF STEAM TRAP	KEY ADVANTAGES	SIGNIFICANT DISADVANTAGES	FREQUENTLY RECOMMENDED SERVICES
Float-and thermostatic (F&T)	Continuous condensate discharge Handles rapid pressure changes High noncondensible capacity	Float can be damaged by water hammer Level or condensate in chamber can freeze, damaging float and body Some thermostatic air vent designs are susceptible to corrosion	Heat exchangers with high and variable heat-transfer rates When a condensate pump is required Batch processes that require frequent start-up of an air -filled system
Inverted bucket (IB)	Rugged Tolerates water hammer without damage	Discharges noncon-densibles slowly (additional air vent often required) Level of condensate can freeze, damaging the trap body (some models can handle some freezing) Must have water seal to operate, subject to losing prime Pressure fluctuations and superheated steam can cause loss of water seal (can be prevented with a check valve)	Continuous operation where noncondensible venting is not critical and-rugged construction is important
Wax or liquid expansion thermostatic (TS)	Utilizes sensible heat of condensate Allows discharge of non- condensibles at start-up to the set point temperature Not affected by superheated steam, water hammer, or vibration Resists freezing	Element subject to corrosion damage Condensate backs up into the drain line and/or process	Ideal for tracing used for freeze protection Freeze-protection, water and con-densate lines and traps Noncritical temperature control of heated tanks
Balanced pressure thermostatic (BP)	Small and light-mass Maximum discharge of noncondensible start up Unlikely to freeze	Some types damaged by water hammer, corrosion and superheated steam Condensate backs up into the drain line and/or process	Batch processes requiring rapid discharge of noncondensibles at start-up (when used for air vent) Drip-legs on steam mains and tracing Installations subject to ambient conditions below freezing
Bimetal thermostatic (BM)	Small and light-mass Maximum discharge of noncondensibles at start-up Unlikely to freeze, unlikely to be damaged if it does freeze Rugged, withstands corrosion, water hammer, high pressure and superheated steam	Responds slowly to load and pressure changes More condensate back-up than BP trap Back-pressure changes operating characteristics	Drip legs on constant-pressure steam mains Installations subject to ambient conditions below freezing
Thermodynamic (TD)	Rugged, withstands corrosion, water hammer, high pressure and superheated steam Handles wide pressure range compact and simple Audible operation warns when repair is needed	Poor operation with very low-pressure steam or high back-pressure Requires slow pressure build-up to remove air at start-up to prevent air binding Noisy operation	Steam mains drips, tracers Constant-pressure, constant-load applications Installations subject to ambient conditions below freezing

7. DESIGN CRITERIA

Surveys have found that only 58% of all steam traps are functioning properly. Other studies have found that almost half of all failures were not due to normal wear, but were, in fact due to misapplication, undersizing, oversizing, or improper installation.

That is why it is essential to follow these three steps (in addition to proper steam trap installation, checking and trouble shooting and correct steam trap maintenance) for successful steam trapping:

1) Application definition
2) Steam trap selection
3) Steam trap sizing.

7.1 Application Definition

Steam trap application fall into two categories:

1) Drip and tracer
2) Process.

7.1.1 Drip and tracer traps

Drip traps drain condensate caused by natural heat loss that is formed in steam mains and steam driven equipment. If this condensate remained in the piping, water hammer, corrosion and damage to the piping, valving and equipment would occur. Tracer traps drain condensate from steam tracers, which is tubing or pipe strapped to a process pipeline, water line, or instrument to keep it warm. Winterization tracing protects against freezing, while process tracing maintains the temperature of process liquids. Both drip and tracer traps are for system "protection". The failure of these traps can cause severe and costly consequential damages.

7.1.2 Process traps

Process application fall into four categories based on the type of equipment, with steam either heating a liquid indirectly, air or gas indirectly, a solid indirectly, or a solid directly. Table 2 provides examples of each type of process application.

TABLE 2 - CATEGORIES OF PROCESS STEAM TRAP APPLICATIONS

TYPE OF HEATING EQUIPMENT	TYPICAL EXAMPLES OF EQUIPMENT BEING HEATED
1. Steam heats a liquid indirectly	Submerged surfaces (batch still, evaporator, fuel heater, shell and tube exchanger, tank coil, vat water heater) Jacketed vessel (pan, kettle, concentrator) lift or syphon drainage (tilting kettle, sulfur pit, submerged pipe or embossed coil, shipboard tank)
2. Steam heats air indirectly	Natural circulation (dry air: convector, pipe coil, moist air: blanket dryer, dry kiln, drying room). Forced circulation (air blast heating coil dry kiln, air dryer, pipe coil, process air heater, unit heater)
3. Steam heats a solid or slurry indirectly	Gravity drained (chest-type ironer, belt press, chamber dryer, hot plate, platen) Syphon drained (cylinder ironer, cylinder dryer, drum dryer, dry can, paper machine)
4. Steam heats a solid directly	Gravity drained (autoclave, reaction chamber retort, sterilizer)

7.2 Steam Trap Selection

After defining the application, the next step is to select the correct type of steam trap based on performance criteria such as design failure mode (open or closed), speed of response, air handling capability, ease of checking, environment high or low temperature), potential for water hammer in the system, range of pressure operation and the presence of super-heat. With rare exception, a steam trap should always be selected for failopen service. Other criteria which are more feature-oriented include ease of maintenance, (see Appendix E) ease of installation (including flexibility of horizontal or vertical piping) and integral strainer and blowdown valve. Table 3 provides some selection guidance. Selected trap types are subject to Company's approval.

TABLE 3 - CHART TO BE USED FOR NARROWING THE CHOICE OF STEAM TRAP TYPE

TYPE OF STEAM TRAP	FAILURE MODE	OPERATES OVER WIDE PRESS. RANGE	EASY TO CHECK	AIR HANDELING ABILITY	DESIGNED FOR SUPERHEAT	DESIGNED FOR FAST RESPONSE	RESISTANT TO WATER HAMMER
Mechanical							
F&T	Closed or open	No	No	Excellent	No	Yes	No
IB	Closed	No	Yes	Poor	No	Yes	Yes
Thermostatic							
Bellows	Closed or open	Yes	No	Excellent	No	Yes	No
Bimetal	Open	No	No	Fair	Yes	No	Yes
Diaphragm	Closed or open	Yes	No	Fair	No	No	No
Thermodynamic							
Disk	Open	Yes	Yes	Poor	Yes	Yes	Yes
Piston	Open	Yes	Yes	Good	Yes	Yes	Yes
Lever	Open	Yes	Yes	Good	Yes	Yes	Yes

When choosing a steam trap, the following steam trap codes and standards which define steam trap design, performance and manufacturing are applicable:

1) ANSI/ASME PTC 39.1, "Performance Test Code for Condensate Removal Devices for Steam Systems"
2) ANSI/FCI 69-1, "Pressure Rating Standards for Steam Traps"
3) ANSI/FCI 85-1, "Standards for Production and Performance Tests for Steam Traps"

7.3 Steam Trap Sizing

Once the correct trap type has been selected. it must be sized. A steam trap must be sized based on the condensate load, not pipe size. Sizing a trap based on pipe size typically results in an oversized trap, which will cycle more frequently or operate with the valve too close to the seat, causing wear and short service life.

The procedure for sizing a steam trap is to first calculate the condensate load based on equations (or other means) subject to Employer approval. Once the condensate load has been calculated, the trap should be sized using a reasonable safety factor. For drip and tracer applications, which typically operate at constant steam pressure and have relatively light condensate loads, a safety load factor of 2 to 3 shall be considered.

Size of trap’s condensate lines/subheaders/headers shall be enough to avoid excessive back-pressure on trap to facilitate proper trap functioning.

Process applications, however typically operate with a controlled steam supply with variable pressure and have condensate loads that are both variable and heavy. The appropriate safety load factor will depend on such factors as the heating category (as defined in Table 2), the type of equipment and whether the steam pressure is constant or variable (the latter of which implies the use of control valves to regulate steam pressure based on a signal from the process controller). Values range between 2 and 5. Table 4 shall be used to select the safety load factor.

TABLE 4 - CHART TO BE USED FOR SELECTION OF SAFETY FACTOR FOR TRAPS IN PROCESS APPLICATION

HEATING CATEGORY *		STEAM PRESSURE	
		CONSTANT	VARIABLE
1	Drainage to trap: Gravity Syphon/Lift	 2 3	 3 4
2	Ambient air: 0°C and higher Below 0°C	 2 3	 3 4
3	Drainage: Gravity Syphon	 3 5	
4	Warm-Up: Normal Fast	 3 5	

*** From Table 2.**

7.3.1 In addition to the considerations mentioned above, the following items shall be strictly followed:

1) Impulse type steam traps shall be used for general service such as headers, branches and tracing as detailed in the relevant piping specifications.

2) Inverted bucket traps shall not be used without written permission from Company in cases where these types apply.

3) Vacuum of lift traps shall be used for draining condensate from low pressure systems where the available pressure differential is too low for other types of traps.

4) Automatic drain valves, either float or diaphragm type for draining condensate or liquid from air or gas lines and receivers shall be used.

5) Ball float traps (continuous drainers) shall be used for modulating service such as draining condensate from temperature controlled reboilers, for trapping liquid in gas or air streams and for venting air or gas from liquid streams.

6) Strainers shall be installed in the piping upstream of all continuous drainers. Metallic gaskets shall be used for steam pressure above 2000 kPa (ga) and/or 20 bar (ga). integral strainers are preferred.

7) The body material for ball float traps and automatic drain valve shall be as follows:

a) 1700 kPa (ga) and/or 17 bar (ga) and lower, cast steel;
b) over 1700 kPa (ga) and/or 17 bar (ga) forged steel or stainless as applicable.

8) End connections shall conform to piping specifications, except for steam tracing traps which shall be screwed type.

9) Trim material for traps and strainers shall be stainless steel.

10) The body material for steam tracing traps shall be stainless steel.

11) Minimum body size shall be DN15 (½" NPS) for traps in steam tracing or unit heater services. Minimum size shall be DN 20 (¾" NPS) for all other traps.

7.3.2 For traps in winterizing and heat conservation services the items listed below shall be strictly followed:

1) Condensate collecting piping for grouped tracer traps shall be such as to avoid excessive back pressure on traps and trap discharge lines and should be based on the lowest expected steam supply pressure. Minimum size of condensate collecting piping for grouped tracer traps shall normally be as follows:

- 1 to 2 traps DN20 (¾" NPS)
- 3 to 5 traps DN25 (1" NPS)
- 6 to 15 traps DN40 (1½" NPS)

2) Each tracer shall have its own steam supply valve and steam trap.

3) For heat conservation service, each trap shall have a block valve upstream and downstream of trap. Traps will have an integral strainer and plugged drain. In winterization service no blocks will be required at steam traps. Drains will be valved.

4) Steam trap shall be impulse tilting disc type with DN15 (½") or DN20 (¾") threaded ends with integral strainers and blow off valves with removable internals as shown in Appendix E. Body shall be forged steel, seat and disc shall be stainless steel or stellited. Traps shall be preferably installed with the flow down. If the trap is in a horzontal run, it shall be installed on its side to prevent freezing.

5) The condensate discharge from the tracers shall be carried out through one steam trap for each individual tracer. The steam trap may service two tracers only if they are tracing the same pipe in parallel for the same length and follow the same route. The steam trap may collect the discharge of more tracers in the particular cases of pumps and instrument tracing provided the tracers are completely self-draining with no pockets.

6) Valves and piping at trap shall be same size as the trap size.

7) Piping from the trap discharge to the header shall normally be DN15 (½") minimum piping. Condensate recovery shall be 100%, however in exceptional approved cases where it is not practicable to recover, discharge piping shall be short, without elbows and discharged into sewage or into a properly designed soakaway sump.

8) Instrument steam tracers shall be supplied only from independent main headers which will not supply steam to any other facility.

9) For detail of condensate collection system reference shall be made to IPS-E-PR-420, "Process Design of Heat Tracing & Winterizing".

8. COMMON PROBLEMS OF STEAM TRAPS

8.1 Freezing

If subjected to ambient conditions below 0°C, condensate in the trap will freeze unless it is continuously replenished with hot, newly formed condensate. Generally, freezing is a problem only when the steam system is shut down (or idled) and a heel of condensate remains in the trap.

Some traps, such as the Float-and-Thermostatic (F & T) and Balanced Pressure (BP) traps using conventional bellows, are more easily damaged by freezing than other types of traps. The Inverted Bucket (IB) trap can also freeze, subjecting its body to damage.

8.2 Air Binding

Air and other noncondensibles in the steam system reduce heat-transfer rates and can confound steam trap operation. When subjected to excessive air removal requirements, thermodynamic traps can stay closed longer than normal and IB traps will release the air only very slowly. When these types of traps are used for frequently shut-down batch operations, the steam system should be fitted with an auxiliary vent for noncondensibles. Such a vent valve is usually similar in design to a BP trap. It should be installed at a high point in the steam system or parallel with the trap.

8.3 Noise

Noisy operation is generally not a problem with steam traps that discharge condensate to a closed pipe. With the exception of the thermodynamic trap, most traps tend to operate relatively silently. In some circumstances, however, a trap may cause a slight, audible "woosh" sound as condensate flashes into steam downstream of the trap valve. Noise in steam systems is usually caused by lifting condensate up vertical return lines, water hammer, or a failed trap that leaks live steam into a condensate line.

8.4 Steam Leakage

Like any valve, the valve seat in a steam trap is subjected to erosion and/or corrosion. When seat is damaged, the valve will not seal completely and the trap may leak live steam. Some trap designs allow seat replacement without removing the trap body from the line, others may require replacement of the entire trap.

Steam trap valve seats are specially susceptible to a type of erosion called "wire drawing". This phenomenon is caused by high-velocity droplets of condensate eroding the valve seat in a pattern that looks like a wire has been drawn across the surface. Oversized traps are more susceptible to wire drawing.

8.5 Insufficient Pressure Difference

Steam traps rely on a positive difference between process steam pressure and the pressure downstream of the trap to remove condensate. If such a difference is not present, condensate will not drain from the trap and a pump will be required.

There are two circumstances where insufficient pressure difference will occur:

1) When the pressure downstream of the trap is too high because of overloading of a condensate return line (that is high back-pressure).

2) When the process steam pressure is too low. This condition frequently occurs in modulating service where the process temperature controller throttles steam pressure in the exchanger to a pressure below that of the pressure downstream of the trap. In some circumstances the pressure in the exchanger will actually fall below atmoshperic pressure if the exchanger calls for a heat source below 100°C.

When either circumstance occurs, condensate will back up into the exchanger, no matter which type of trap is used. In modulating service, the temperature controller will eventually increase the steam pressure and force the condensate out of the trap. This filling and emptying of the exchanger causes temperature cycling that cannot be controlled by any instrumentation system. Also, when the high-pressure steam forces condensate out of the exchanger at a high velocity, the exchanger will be subject to physical damage from water hammer. The tube bundle may also be corroded at the condensate-steam interface inside the exchanger.

(This interface is a point at which the corrosive effects of oxygen and CO_2 in the steam can be concentrated.)

The only way to stabilize condensate removal in such circumstances is to install a condensate pump in conjunction with the trap.

8.6 Dirt

Steam condensate often contains particles of scale and corrosion products that can erode trap valves. If the particles are large enough, they can plug the trap discharge valve or jam it in the open position. Levers in the F&T and IB traps can also can be jammed by particulates and valve movement in BM traps can be restricted by solids jammed between the bi-metal plates.

To extend trap-life, a strainer should be installed immediately upstream of each trap. Strainers should be cleaned frequently when the system is first started up and when any steam piping is replaced so that any millscale present is removed upstream of the trap. Subsequently, strainers should be cleaned on schedule consistent with how quickly they load up with particulate.

8.7 Maintenance

Most traps can be repaired rather than replaced. The repairs can usually be done in-line without removing the trap body from the connecting piping. Such repairs usually require less labor than replacement, because removing the trap cover is easier than removing the trap from the line. Repairing the also eliminates the possibility of having to replace pipe if the trap piping is damaged when the trap is removed. Of course, it also costs less to buy trap parts than to buy an entire trap.

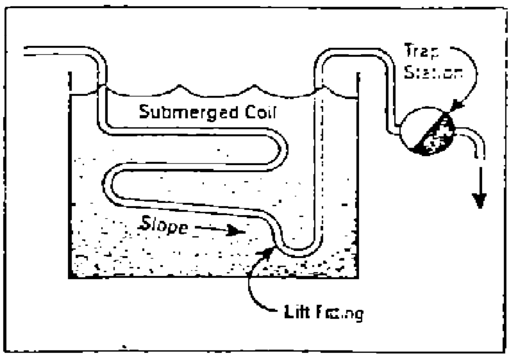
9. PROPER STEAM TRAP INSTALLATION

Certainly, steam traps should be installed according to the manufacturer’s guidelines. There are, however, some basic considerations worth noting.

First, condensate gets into steam traps by gravity. Thus, a steam trap should always be installed below the equipment that is being drained by gravity flow.

However, there are applications where a steam trap can not be installed lower, such as buried tanks, drop-in (submerged) heating coils, or rotating drum dryers.

In these instances, special consideration should be given to providing tank coils with a lift fitting, as shown in Fig. 1 and utilizing steam traps with control orifices to vent flashed condensate.

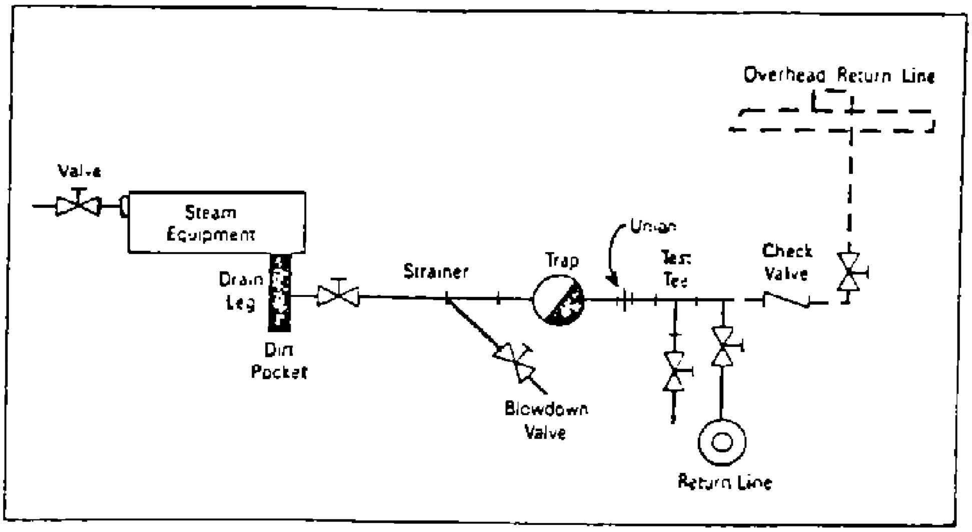


A LIFT FITTING MUST BE INSTALLED TO DRAIN CONDENSATE FROM EQUIPMENT THAT IS LOWER THAN THE STEAM TRAP

Fig. 1

A lift fitting is a loop into which condensate drains, a syphon tube is then placed down into it to syphon out the condensate. Control orifices are orifices in steam traps to vent flash vapor by providing continuous drainage (that is, the trap never shuts tightly). Control orifices are common to thermodynamic piston and lever traps, other types of traps may have internal or external orifices, but only if specified as an option.

Beyond gravity drainage, proper trap station and support shall be considered. Fig. 2 shows a typical steam trap station with recommended piping and specialties.



A TYPICAL STEAM TRAP STATION WITH ASSOCIATED PIPING AND AUXILIARY EQUIPMENT
Fig. 2

Some key points to remember are:

1) Adequate drain legs should be provided to ensure collection and storage of condensate prior to the trap to permit operation free of water hammer. Size of drain legs should be the same as the equipment outlet connection and generally 460-610 mm long. Their length is generally limited based on the equipment installation and clearances to grade.

Process equipment engineers should consider these necessary clearances when designing equipment support structures.

2) A Y-type strainer (integral or separate) with blowdown valve is essential. Dirt is a major cause of steam trap failures. The strainer catches impurities and can then be flushed to remove them.

In addition to protection from dirt, a strainer is also a good diagnostic tool. A cold trap can be checked by simply blowing down the strainer. If pressure is present, the trap is either failed closed or plugged with dirt. It is also possible that a downstream condensate valve is closed or some other restriction exists. And most important, the strainer blowdown valve depressurizes the trap station for safe maintenance.

3) A test tee should be installed in systems where condensate is collected and either returned to the boiler or some other location. A test after the trap provides quick visual examination of trap discharge for ease of checking and troubleshooting.

4) Steam trap stations that include isolation block valves allow steam trap maintenance to be performed without having to turn off the steam supply at the root valve (that is, steam supply valve or the first valve in the system).

5) Flanges or pipe unions may be required for installations that use nonrepairable steam traps or repairable steam traps that require removal from the pipe for repair. In threaded pipe installations, only downstream unions or flanges are recommended, as upstream unions or flanges may leak and cause expensive high pressure steam to be lost.

Flanges or unions will not be needed if in-line renewable steam traps are used for simplicity of installation and reduction of maintenance costs. (The term "renewable" is an alternative to "repairable". Repairing implies changing a bad part.

In renewable steam traps, the maintenance results in a "new" trap, in that the valve, seat and (operating mechanisms are all replaced.)

Bypasses around steam traps are to be installed when traps are needed to be removed or repaired, or when traps could not handle either the air or the heavy condensate load during start-up.

In rare instances, where the process can not even be shut sown for quick in-line maintenance of the steam trap, installing a backup steam trap with the necessary valves, strainers and so on in parallel is the best alternative arrangement.

Simple instrumentation with pressure gages and thermometers on the upstream and downstream side of steam traps in critical process applications can provide valuable assistance in future troubleshooting of system problems and trap performance. Such instrumentation is recommended for process heat exchangers where loss of temperature control may ruin a batch of material and cause significant monetary losses. Steam main drips and tracing do not require such monitoring.

Typical steam trap piping is shown in Appendix B. Proper drip pot installation and general notes applicable to typical steam trap piping drawing (in Appendix B) are shown in Appendix C.

Insulation is an enemy to a good steam trap maintenance program and should not be used. To avoid problems, it is recommended that pipe insulation start approximately 300 mm. upstream and downstream from the trap. Insulating steam traps makes them difficult to check and maintain because once insulated, a steam trap may never be accessed unless it is clearly affecting process operation. Additionally, the performance of a steam trap can be affected by insulation, thermostatic traps, for example, tend to be sluggish when insulated and bucket traps can lose their prime (that is fail open).

As for safety, the use of expanded metal screening wrapped around a trap, instead of insulation, can provide personnel protection where necessary.

APPENDICES

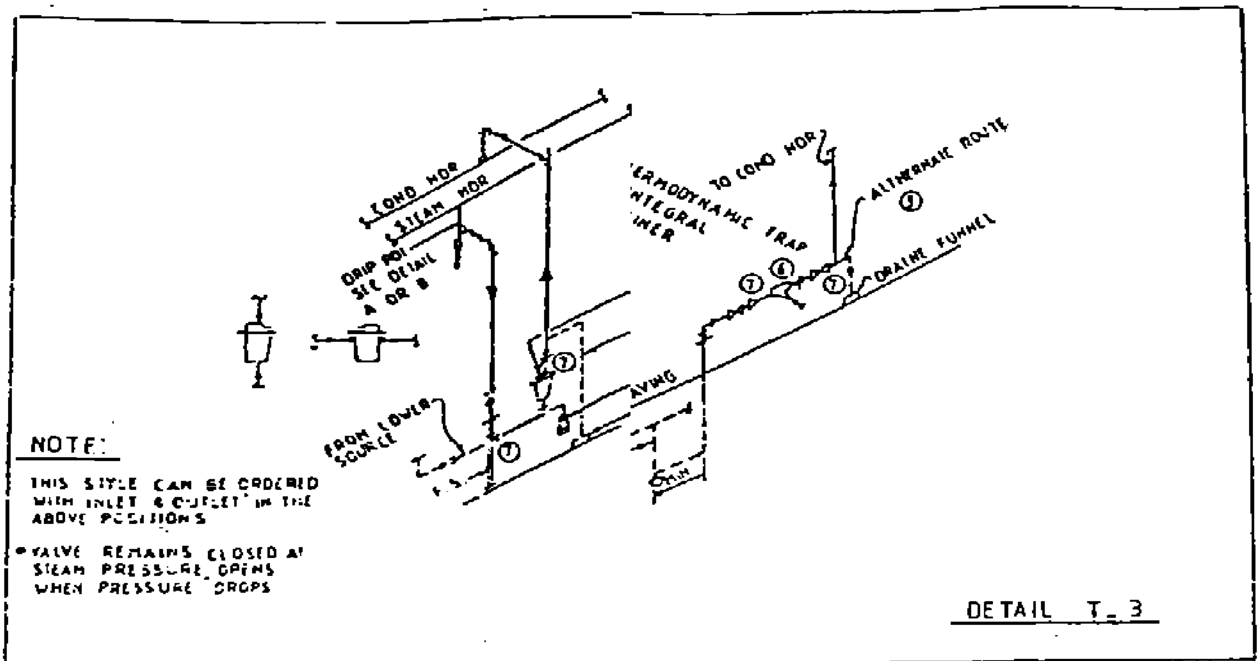
APPENDIX A

TYPICAL STEAM TRAP DATA SHEET

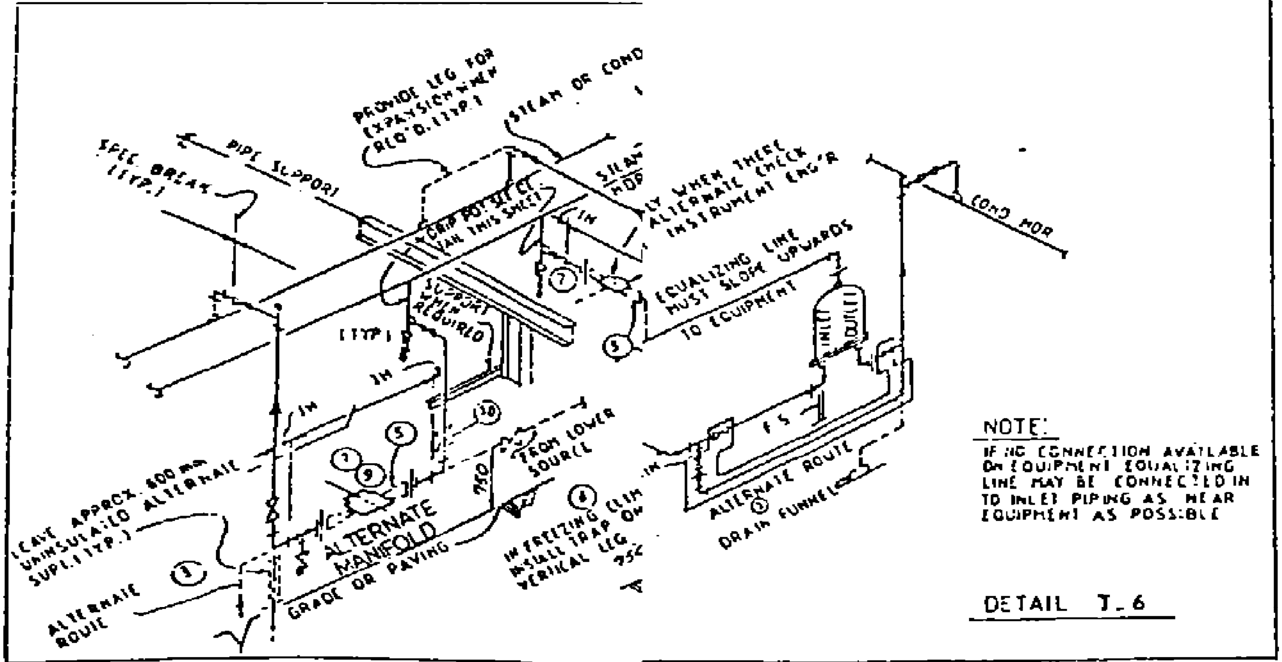
INSTRUMENT SPECIFICATIONS

General	+1	Tag No.	
	+2	Flowsheet: frame No.	
	+3	Quantity	
	+4	Service	
	+5	Installation (horizontal/vertical)	
	6	Type	
Body	7	Test pressure (hydraulic)	
	+8	Material	
	9	Size Inlet | Outlet	
	+10	End connections/flange facing	
	+11	Rating: press: temp. (bar: °C)	
	12	Equalization conn. size	
	13	Conn. orientation	
	14	Drain connection (plugged/valved)	
IRM	+15	Material	
	16		
Accessories	17	Internal check valve	
	18	Internal bi-metallic vent	
	19	Thermostatic Vent | Material	
	20	Gage glass	
	21		
Strainer	22+	Internal-External	
	23	Type: size	
	24	Body material	
	25	Rating: Press.: Temp.:	
	26	End connections	
	27	Blowoff connections	
	28	Mesh size: material	
Process	29	Heat treatment	
	30+	Fluid	
	31+	Normal flow kg/h | max. flow kg/h	
	32+	Load safety factor	
	33	Max. capacity kg/h	
	34+	Flow temp. °C | °C superheat	
	35+	Pressure bar (ga) in | out	
	36+	Allow press. diff. bar max. | min.	
	37+	R.D (S.G): F.T. top | bottom	
Orifice	38	Calculated	
	39	Selected	
	40		
MFR	41	Outline dimensions	
	42	MFR. model No.	

APPENDIX B
TYPICAL STEAM TRAP PIPING

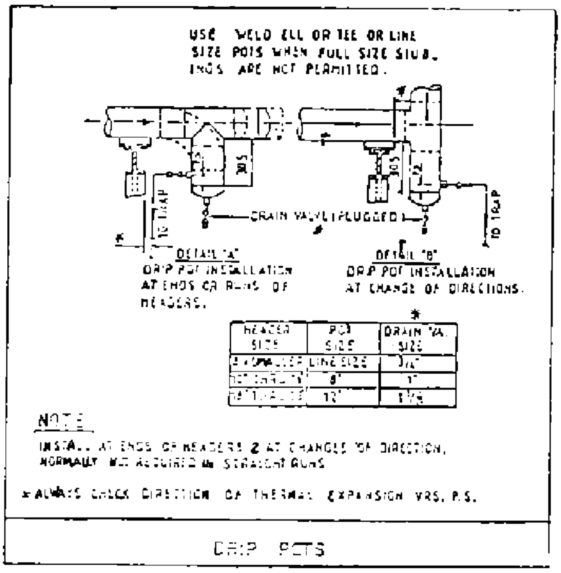


BUCKET TRAP GROUND STEAM PIPING
PIPING ARRANGEMENNG ARRANGEMENT



THERMODYNAMIC TRAF FLOAT TRAP
(IMPULSE TRAP) NTINUOUS DRAINAGE

APPENDIX C
DRIP POT INSTALLATION AND GENERAL NOTES APPLICABLE TO STEAM TRAPPING



General Notes:

1) Traps should be installed so that they are within reach of grade, a platform or portable ladder & are close to and preferably below the equipment being drained.

2) Maximum spacing of traps to drain steam headers

a) Saturated steam 76 m
b) Superheated steam 152 m

3) In cold climates avoid discharging condensate to open drains within operating area, and under stairways and ladders.

4) Strainer not required if intergral with trap.

5) Swage as required for reduction from line size.

6) When a trap is used for steam tracing, the steam & condensate lines may be run together in a common insulator.

7) When a sight glass is provided, trap must be installed in a horizontal position with glass in front or in a vertical position.

8) This detail is typical of all steam tracing trap installation.

9) If impulse trap is located in horizontal, it shall be installed on its side to prevent freezing.

10) Locate block value here when location at header is inaccessiale from a portable ladder.

11) Valves and piping at trap shall be same size as trap size.

12) Trap manifolding arrengements shall be located about pipe support columns.

13) For heat conservation service each trap shall have a block valve upstream and downstream of trap. Traps will have an integral strainers and plugged drain.

14) In winterization servise no blocks will be required at steam traps, drains will be valved.

15) In freezing climates the use of vertical steam and condensate headers should be considered for purposes of steam tracing.

APPENDIX D
PIPE COMPONENT-NOMINAL SIZE

The purpose of this Appendix is to present an equivalent identity for the piping components nominal size in SI System and Imperial Unit System, in accordance with ISO 6708-1980 (E).

TABLE 1 - PIPE COMPONENT - NOMINAL SIZE

NOMINAL SIZE		NOMINAL SIZE		NOMINAL SIZE		NOMINAL SIZE	
DN (1)	NPS (2)	DN	NPS	DN	NPS	DN	NPS
6	¼	100	4	600	24	1100	44
15	½	125	5	650	26	1150	46
20	¾	150	6	700	28	1200	48
25	1	200	8	750	30	1300	52
32	1¼	250	10	800	32	1400	56
40	1½	300	12	850	34	1500	60
50	2	350	14	900	36	1800	72
65	2½	400	16	950	38		
80	3	450	18	1000	40		
90	3½	500	20	1050	42		

1) Diameter Nominal, mm.

2) Nominal Pipe Size, inch.

APPENDIX E

DETAILS OF THERMODYNAMIC STEAM TRAP (WITH REMOVABLE INTERNALS)