Control Valves • Actuators • Injection Coolers • Accessories

MIL 63000

Desuperheater

MIL

KSB

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Introduction

In the steam producing and consuming industries the steam raised in steam generators must be brought to particular user conditions.

In general there are two different duties to be fulfilled:

Case A: Steam pressure remains constant, steam temperature shall be reduced.

Case B: Steam pressure and steam temperature shall be reduced.

The selection of the right steam reducing valve requires knowledge of the duty and the physical possibilities:

When adding cooling water, the optimum contact surface area must be exposed to the steam. The water droplets must be as small as possible and maximum in number to remain suspended which helps in immediate evaporation and absorption of thermal energy from steam, thereby reducing its temperature.

The greater the desired temperature reduction, the greater the necessary cooling water quantity: the water/ steam ratio increases.

The thermal condition of the steam - greatly superheated or near the saturated steam line – is a further criterion. In the case of high pressure steam the surface tension of the water drop is low, atomizing takes place without a great energy requirement and mostly in the vicinity of the spray position.

The readiness to spontaneous evaporation decreases markedly when the steam condition approaches the saturated steam line.

In addition, the inlet temperature of the cooling water plays a major role: "cold water" requires more energy to evaporate completely, thereby reducing the required cooling water quantity. However this may lead to longer life time of the water droplet to evaporate in the steam flow resulting in a related danger of thermal shock for surrounding components.

"Hotwater" of min. 120°C or more if possible is subject to a kind of "explosion atomizing". This additional atomizing is responsible for an increased spontaneous evaporation and the effect of thermal shock is considerably abrogated. The extra amount of cooling water required is negligible for above reasons.

Another important parameter is the relative velocity between water droplets and the steam to be cooled. At the instant of evaporation a saturated steam mantle forms around the water drop, the insulating effect of which hinders further spontaneous evaporation of the droplet.

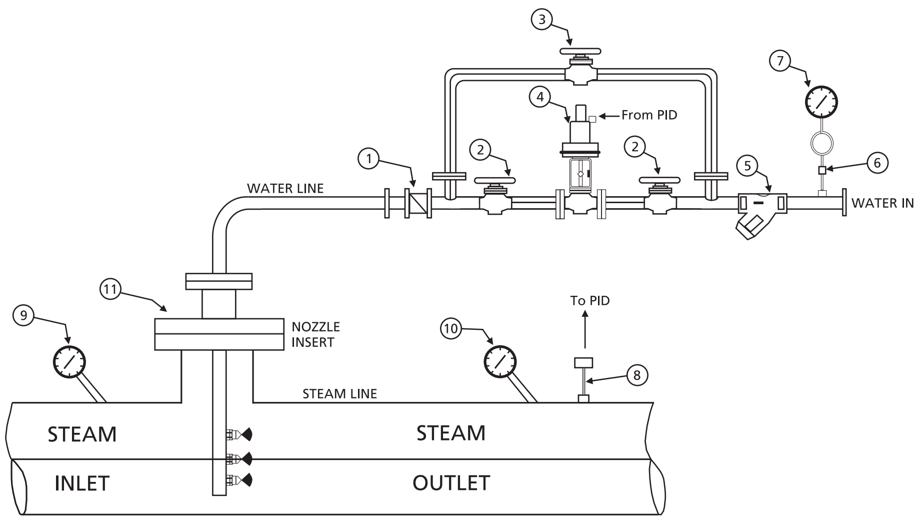
Relative velocity between water drop and steam molecules shall be as great as possible is desired, in order that, the steam mantle is "blown away" and further evaporation can proceed. Especially with part load steam quantities having low flow, velocity is even more limited.

Selection aids for suitable valves

Case A: Recognizing the background knowledge, a steam cooler of the mechanical atomizing type can be located direct in the steam line. Cooling water from a higher pressure is sprayed into the steam atmosphere by using its pressure drop for atomizing.

Case B: The steam can be throttled in a pressure reducing valve and a cooler (as case A) fitted downstream. For effective selection of Desuperheater higher level of expertise is required.

Normal Desuperheater Control Loop



MODEL NO	BILL OF MATERIAL
1	Non return valve
2	Gate valve
3	Globe valve
4	Temperature Control Valve
5	Strainer
6	Stop Valve
7	Pressure Gauge
8	Temperature Sensor
9	Inlet Temperature Gauge
10	Outlet Temperature Gauge
11	Desuperheater

Areas of Application

Sector	Applications
Power Generation	Ejector & Gland sealing PRDS Deaerator pegging PRDS Auxiliary PRDS Condenser Dump PRDS Turbines bypass
Process Application	Reduce temperature of steam from boiler to economic levels
Paper and Board Industry	Drying Machines
Chemical and Pharmaceutical Industry	Steam boiler to process Steam to Heater coils
Oil & Gas Industry	Bypass and let down stations Start up heaters Steam supply to process heaters Compressor discharge
Others	Food, textile, brewing also find applications where steam generated is reduced to lower temperature and pressure for different process applications

Model Decodification

1st	2nd	-	3rd	4th	5th	6th	7th
–	–	-	6	3	0	–	–

ACTUATOR TYPE[1]	SERIES	TYPE	NOZZLE TYPE	NO: OF STAGES [1]
37. Direct Spring Diaphragm 38. Reverse Spring Diaphragm	63. Desuperheater	0. Undefined 1. Lance	0. Undefined 1. Fixed 2. Spring Loaded 3. Variable Orifice	0. Undefined 1. Single Stage 2. Two Stages

(1) Applicable only for Variable orifice

MIL 96110 - Fixed Orifice Nozzle (Type I)

Size

Steam pipe size:	3" to 24"
Water pipe size:	1" to 3"
Pressure rating:	150# to 2500# ASME

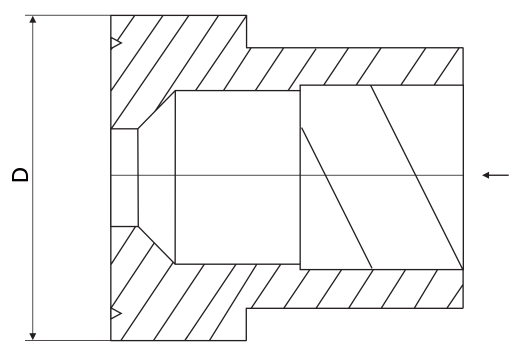
Material

Body Material:	Forged Steel - A105, F11, F22
Nozzle Material:	1.4012

Applications

- Low pressure Desuperheater
- Process Steam Desuperheater

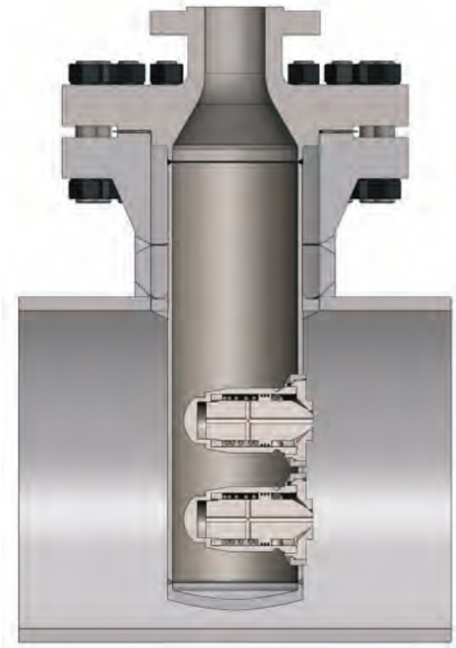
- Easy Maintenance
- Imported Nozzles
- Rangeability- 1:5
- Multinozzle Design
- Fixed Area Nozzle
- Lack of moving parts
- External temperature control valve



Nozzle with direction insert

	NOZZLE TYPE														
	Nozzle type A D=12			Nozzle type B1 D=12				Nozzle type C1 D=18					Nozzle type D1 D=20		
MIL Int. No:	4880	4875	4994	4191	4192	4193	4194	4195	4196	4197	4198	4199	5233	5537	5535
Range of Use △P															
2	0.009	0.012	0.019	0.024	0.040	0.049	0.065	0.089	0.115	0.151	0.165	0.178	0.210	0.232	0.260
4	0.013	0.017	0.027	0.034	0.057	0.070	0.092	0.126	0.163	0.213	0.234	0.253	0.297	0.328	0.380
6	0.016	0.020	0.033	0.041	0.070	0.085	0.114	0.154	0.200	0.261	0.286	0.309	0.364	0.402	0.460
8	0.018	0.024	0.038	0.048	0.081	0.100	0.131	0.178	0.231	0.302	0.330	0.357	0.420	0.465	0.530
10	0.021	0.027	0.043	0.054	0.091	0.111	0.147	0.200	0.259	0.338	0.370	0.400	0.470	0.520	0.600
12	0.023	0.029	0.047	0.059	0.099	0.121	0.161	0.219	0.283	0.370	0.405	0.438	0.514	0.569	0.650
14	0.024	0.031	0.050	0.063	0.105	0.131	0.173	0.236	0.306	0.399	0.437	0.473	0.556	0.615	0.700
15	0.025	0.033	0.052	0.066	0.110	0.136	0.180	0.244	0.317	0.413	0.453	0.489	0.575	0.636	0.730
16	0.026	0.034	0.054	0.068	0.115	0.140	0.185	0.252	0.327	0.427	0.468	0.505	0.594	0.657	0.750
18	0.028	0.036	0.057	0.072	0.122	0.149	0.197	0.268	0.347	0.453	0.496	0.536	0.630	0.697	0.800
20	0.029	0.038	0.060	0.076	0.128	0.157	0.207	0.282	0.366	0.478	0.523	0.565	0.664	0.735	0.840

MIL 96120 - Spring Loaded Nozzle (Type II)



- Spring Loaded
- Rangeability- 1:10
- Multinozzle Design
- Higher Capacity
- External temperature control valve

Nozzle Selection Chart

Nozzle Assembly	Kv Value (in m^3/hr)
Nozzle I	5.75
Nozzle II	9.8
Nozzle III	18.9

Size

Steam pipe size:	6″ to 32″
Water pipe size:	1″ to 8″
Pressure rating:	150# to 2500# ASME

Material

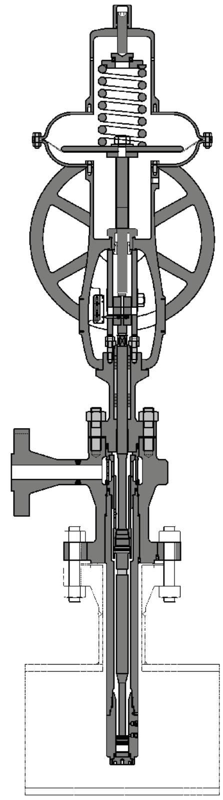
Body Material:	Forged Steel - A105, F11, F22, F91
Nozzle Material:	1.4012

Applications

- PRDS
- Main Steam Desuperheater
- LP Bypass
- Process Steam Desuperheater

MIL 37/38 - 96131/2 - Variable Orifice (Type III)

- Easy Maintenance
- Imported Nozzles
- Rangeability- 1:25
- Higher pressure dropping capacity
- Integral temperature control
- Easy piping layout
- Variable area nozzle



Size

Steam pipe size:	1" to 24"
Water pipe size:	1" to 4"
Pressure rating:	150# to 2500# ASME

Material

Body Material:	Forged Steel - A105, F11, F22
Nozzle Material:	1.4012

Actuator

- Pneumatic Actuators
- Electrical Actuators

Applications

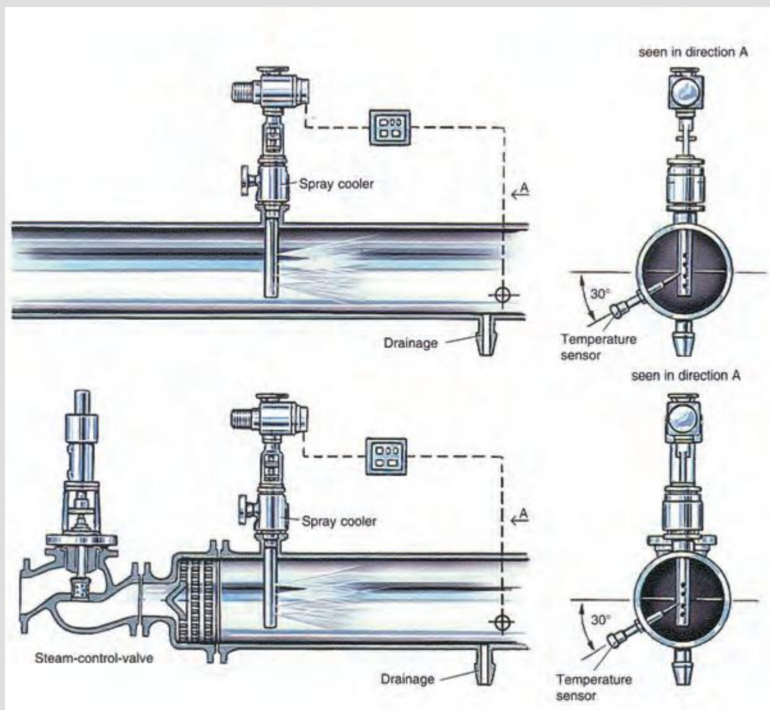
- Low Pressure Desuperheater
- Process Steam Desuperheater

Size	25	25	40	40	50	50	60	60	60	60
Kv_{max} (m^3/h)	0.323	1.0	1.5	2.2	4.2	5.0	5.7	7.2	8.0	8.8

Required sizing parameters

The required sizing parameters include

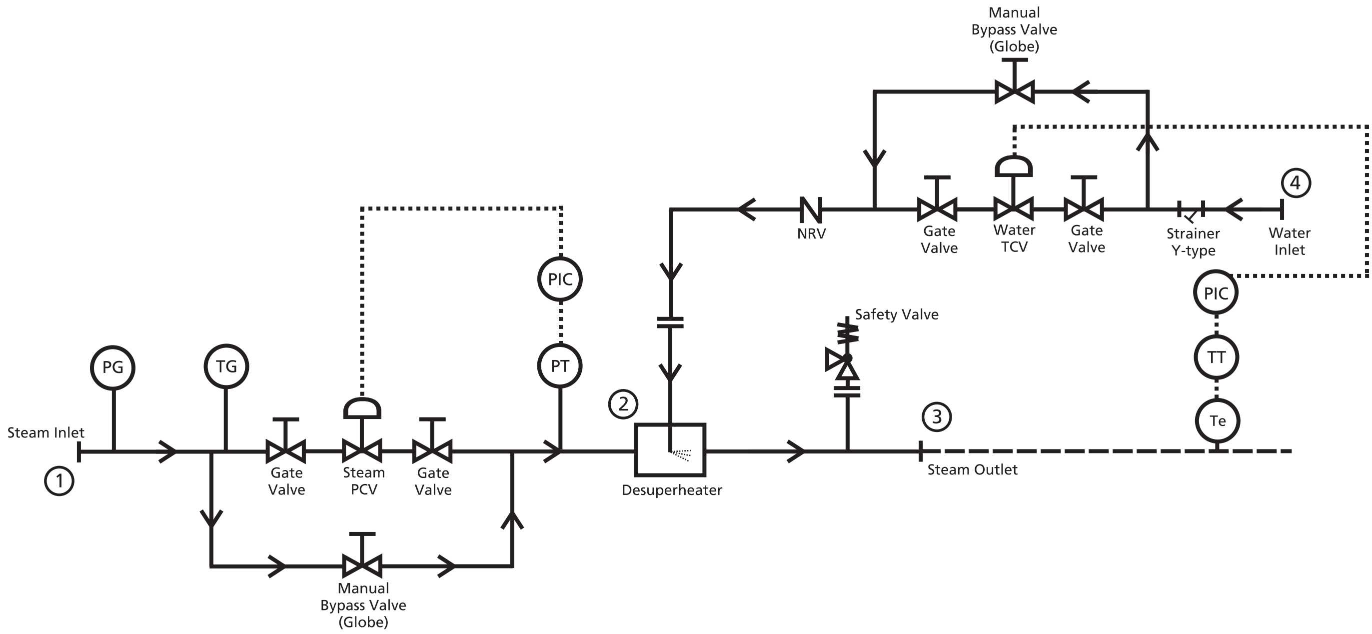
- Steam inlet pressure and temperature
- Desired outlet steam Pressure temperature
- Inlet or Outlet (desired) Steam flow (min/nor/max kg/hr)
- Spray water Inlet Pressure / temperature
- Steam and water Pipe Size/schedule



Injection coolers, seperate or in combination with steam reducing valve

APRDS Skid

Engineered APRDS Skids to suit site layout with all piping, mounting of devices etc. These are fabricated and installed considering all engineering relevant standards and practices. With control valves and desuperheaters produced inhouse and isolation gate valves produced by our parent concern KSB, we offer cost effective solutions. Ensuring that all devices are sourced from quality vendors, and the state of the art quality assurance system in place MIL guaranties system performance.



Typical APRDS skid hook up diagram

Installation & Design Considerations

- Efficient drainage of desuperheater pipeline is essential.
- Cooling water supply should be free of any particle or debris.
- Sufficient straight length are maintained before and after devices. In case the desuperheater is mounted vertically with the steam flow direction upward, the spray water valve should be mounted below this level. An effectively designed desuperheater system does not require a protective liner.
- Cooling water control valve must be selected with class V or VI leakage to avoid thermal shocking.
- Inadequate distance of temperature sensor from desuperheater may lead to poor temperature control.
- The selection of cooling water source may be made allowing maximum possible drop to ensure minimum required differential pressure is available across the nozzles it is also desired to have spray water temperature in excess of 100 deg C for efficient desuperheating.

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