

Pidemco is a service provider for petrochemical, refineries and chemical industries. our services includes but not abridged to design, manufacturing and repair of fixed and rotary equipment. We have been founded at 1994 and since then have provided our services to major Iranian plants and also participated in various national projects.

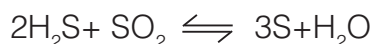
Petrochemical
Industries Design
Equipment & Parts
Manufacturing Co.

Sulfur Condensers Mechanical Design, Fabrication & Quality Control



stage (thermal stage) the acid gas is burnt in a burner and then cooled down in waste heat reboiler. Further it enters catalytic stage in which the sulfur is recovered from the remained H₂S in two or three reactor stages in an equilibrium process.

As an equilibrium process, sulfur content of the gas will impede further recovery of sulfur from H₂S, so sulfur condensers well performance are vital in this process as they condense and extract vaporized sulfur from the acid gas.



Sulfur Recovery Unit and importance of Sulfur condensers

H₂S removed in the AGR process is sent to the sulfur recovery unit (SRU) as acid gas. SRU recovers H₂S as elemental sulfur through the Claus reaction (see the above figure). Reactions occur in two stages: the flame reaction stage and the catalytic reaction stage. The former consists of a high-performance burner, mixing chamber, and heat removing boiler, while the latter has two to three reactor stages. The sulfur recovery rate of the Claus process is about 95% to 97%.

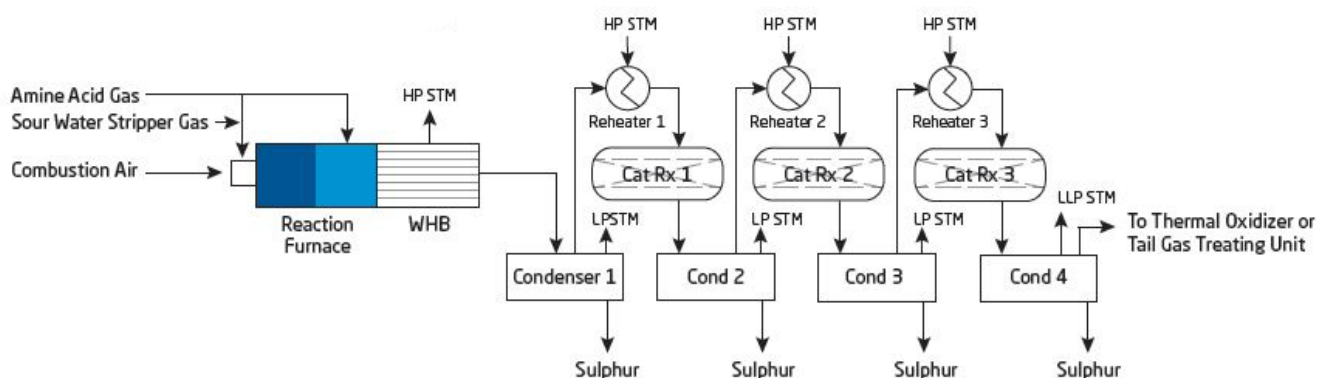
Received acid gas from AGR unit is processed in SRU unit to recover H₂S as elemental sulfur. This reaction takes place in thermal and catalytic stages. In the first

Material Selection

Sulfur condensers are manufactured from carbon steel materials. Raw materials employed shall be Normalized, fully killed and meet NACE MR 0175 requirements. Equipment operating in wet sour services additionally should pass HIC test.

Carbon	0.2% max
Phosphorous	0.020% max
Sulfur (pipe & plate)	0.003% max
(Forge)	0.025% max
Nickel	0.30% max

Welding fillers shall be chosen as low sulfur and Nickel 1.00% max.



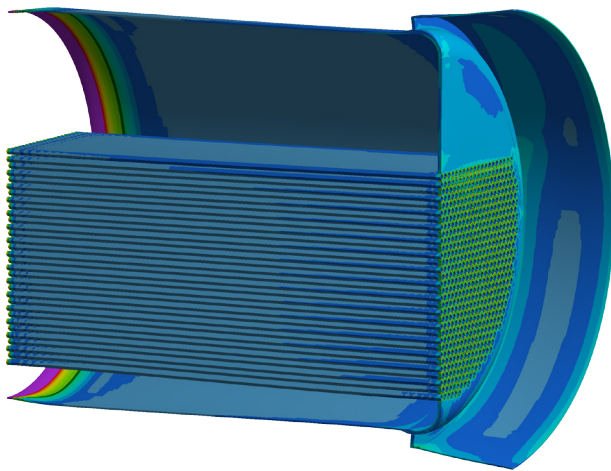
View Point



Mechanical design:

Tubesheet Thickness shall be minimized to withstand thermal induced stresses. Detail Finite element analysis is required to obtain the thinnest possible tubesheet thickness. The model shall include complete heat exchanger including all the tubes and it shall account for thermal differential expansion. Also the necessity of the diagonal stay rods support for top untubed area of tubesheet shall be investigated.

Furthermore, all critical design conditions i.e. Start up, Shut down and abnormal operation conditions shall be checked.



Manufacturing:

Mock up test for tube to tubesheet test is a must in order to ensure adequate fusion of tube and tubesheet. Most of sulfur condensers fail first in this area. Root pass shall be at least be checked by Penetration Test and the most dexterous welders shall be assigned to this job. Low sulfur electrodes shall be implemented and hardness of weld metal and HAZ shall not be over 200 HB. The second most critical area is channel to tubesheet weld. Again great care must be taken in order to achieve the best weld quality.

Light expansion of tubes is suggested after welding away from tube to tubesheet weld. Since tubes are thick in sulfur condensers low tube expansion ratio shall be considered as it may brought tubesheet to undergo plastic deformation and loss of ductility around tubes.

Low sulfur electrodes shall be implemented and hardness of weld metal and HAZ shall not be over 200 HB. Welding shall be done in a way that ensures least welding heat input.

Tubesheet untubed area shall be lined with refractory

in order to reduce the thermal shock in abnormal conditions during operation. Refractory application is vital to equipment lifetime. In Some applications special coatings such as (Thermal Spray Aluminum or Anti Acid liner under refractory is suggested to be used. If refractory anchor size and positioning is not designed accurately they may tend to crack the refractory themselves.



Quality control:

100% welds shall be checked with RT. Tube to tubesheet welds, Nozzle to shall welds shall be checked with UT. After PWHT all welds shall be NDT tested before hydrotest.

Pidemco Experience

Pidemco has delivered many sulfur condensers and this beside the feedback we get from our previous works has given us a deep know-how about design and manufacturing of this equipment.

NO.	CLIENT	YEAR
1	BANDAR IMAM PETROCH. COMPL.	2001
2	KPC	2003
3	TEHRAN REFINERY	2008
4	TEHRAN REFINERY	2010
5	SPGC	2011
6	NARDIS	2013/14
7	TEHRAN RAYMAND	2016