International Journal of Scientific Research and Engineering Development-– Volume 4 Issue 2, Mar- Apr 2021

Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

A Review on Testing of Heat Exchanger

C.BABU, M. SHRE VIJAY RAJ, R. SRIRAM

UG Scholars, Sri Eshwar College of Engineering, Coimbatore-603110, India

Abstract: -

Heat exchanger as the name demonstrates it moves heat from one liquid to another which are at various temperatures. They are too generally utilized in measure applications just as the refrigeration and air molding industry. One can understand their significance just by the reality that any interaction which includes warming, cooling, bubbling, buildup or on the other hand dissipation will require a heat exchanger for these capacities. The finned and non-finned of heat exchanger offers special benefit over other different applications. The fundamental arrangement of finned and non-finned heat exchanger, the warm examination and plan of such exchangers structure n part of mechanical, warm, substance designing researchers for their educational program and exploration action. This exploration paper features finned and non- finned heat exchanger, their plan determinations, thermodynamics perspectives and mechanical applications.

INTRODUCTION: -

The working of heat exchangers in a modern machine is required to work constantly. The petrochemical plants, oil treatment facilities, flammable gas handling, and sewage treatment they are generally utilized region. Heat exchangers are generally used to measure fluid or gas cooling, or steam consolidating, measure fluid, steam or refrigerant vanishing and

all oversee liquids might be isolated can they might be in direct contact. Space warming, refrigeration, cooling, power station, substance plan.

Types of Testing in Heat Exchanger: -

1.Heat Exchangers Hydrostatic Testing:

Set up the Exchangers for hydro test by giving vital blinds and venting courses of numerous other mechanical applications. Heat exchangers have gone a ton of alteration over the ages and have become very examination to their archetypes. The new plans, new materials and have been redone to address explicit issues. From the coolers and forced air systems in our home, to liquefying and freezing, the wonder of heat move is famous

action. In the event that it is shell side pressing factor test, Open cylinder side channels for assessment of cylinder sheet regions. Cylinders and TTS welds will be perfect and dry. Least 2 adjusted pressing factor checks will be utilized for testing. The dial of the measures will be situated so that they are obviously apparent to the administrator controlling the pressing factor during the test. One of the pressing factors measures will be situated in the most

elevated point. Pressing factor measures utilized for testing will have dial graduated over scope of twofold the proposed test pressure. Least of one PSV will be introduced in the test circle to stay away from incidental over compressing. PSV set pressing factor will be 105 % test pressure. Top off shell side with DM water and guarantee water tops off completely by opening the vents. The metal temperature of the pressing factor parts will not be lower than 17°C and not higher than 50°C during pressure test. The test pressure will not be applied until the vessel and the test liquid are at about a similar temperature. Continuously increment the pressing factor. For high test pressures, increment the pressure in advances and hold the pressing factor for length of 5 Minutes at each venture at half, 60%, 70%, 80% and 90% of test pressures. Compression rate will not be more than 0.5 Kg/cm2 each moment. Pressing factor will be additionally expanded until the hydrostatic test pressure is reached. Hold the test pressure until complete check of the Tube, Tube sheet, TTS joints and shell pressure parts and at any rate for Minimum (1.0) one Hour. After complete assessment, all things considered, progressively depressurize the framework from the most noteworthy vent point. Complete steady depressurization of the test pressure will be done in 1.5 Hr. Depressurization ought not be more than 0.5 Kg/cm2 each moment. After depressurization, totally channel the water. Dry and complete cleansing for careful expulsion of water according to the prerequisite

2. HIGH-TEMPERATURE PARTICLE FLOW TESTING: -

Molecule stream testing at raised temperature (600oC) considers the confirmation of a molecule feeder plan that accomplishes identical mass stream paces of particles between the neighbouring vertical channels at conditions delegate of real activity. Identical mass course through the channels is essential for amplifying the generally speaking heat move coefficient U of the warmth exchanger and limiting warm anxieties that can create due to temperature non-consistencies. A mechanical assembly to test the mass stream cone feeder is portrayed in, which comprises of a fake warmth exchanger, mass stream cone and slide door gathering. The counterfeit warmth exchanger is built from 6 mm 316 treated steel plates with 6 mm dispersing, which is reliable with the 100 Kath model plan; nonetheless, sCO2 won't go through the plates. The front substance of the mock warmth exchanger is a quartz window, which considers perception of the molecule stream in the nearby channels at temperature. The quartz window is fixed to the vertical plates by utilizing Fairfax felt protection as a gasket material also, a stabilizer framework has been formulated to give a typical power to pushing the quartz window against the hardened steel plates. The mass stream cone molecule feeder sits underneath the false warmth exchanger, which gives a smooth change from the shell-and-plate heat exchanger cross segment to the slide entryway. The slide door confines the mass stream cone outlet utilizing a tear drop cross segment to give a sluggish change in territory as the slide door is deciphered.

3. TESTING OF A THERMOSYPHON HEAT EXCHANGER: -

Energy saving, for instance by squander heat recuperation, is significant for cost reasons as well as for diminishing essential energy utilization and for lessening carbon dioxide creation. There are numerous sorts of warmth exchanger utilized for squander heat recuperation, including:

- shell and cylinder heat exchanger

-gasketedplate heat exchanger~outable pipe heat exchanger

- heat pipe heat exchanger

- lamella heat exchanger

- twisting warmth exchanger

- revolving regenerative warmthexchanger.

The fundamental benefits of utilizing the warmth pipe heat exchanger are that it has great warmth move qualities, it is reduced, doesn't bring about a huge pressing factor drop, has no moving parts and causes no cross-pollution between the liquid streams. The finned copper thermosyphon heat exchanger had the best execution and showed high viability contrasted and comparative warmth exchangers utilizing other working liquids, like Freon 22 or on the other hand R22. The lower admissible pressure of copper put a restriction on utilizing copper pipe heat exchangers. On account of this impediment, the adiabatic segment temperature working condition was not permitted to surpass 200°C, all together not to surpass the protected working pressing factor. This restriction is loosened up utilizing the finned steel thermosyphon heat exchanger, which will be utilized in the modern application. Since security contemplations are generally significant, steel heat pipe heat exchangers were picked for mechanical applications regardless of lower execution.

4. Heat Exchanger Durability Testing: - for item improvement and creation approval type endorsement close down tests can be attempted, for an entire compass of test boundaries focused on sped up pressure testing of the part. The office conducts, warm cycling, pressure throb, burst testing, tube disintegration, inward fouling, outer surface erosion, spill testing, vibration testing, maturing test, salt shower and "shake and prepare" testing on a scope of warmth exchanger sizes and loads to 100 kg. Full destroy examination and separating of parts for point by point material evaluations directed with FTIR and SEM equipment. Oil and Gas liquid segment testing is accessible for valves, injectors, fittings and hoses for in-administration solidness appraisal, including pressure throb, burst and consumption.

5. Hydraulic Oil to Water heat exchanger thermal efficiency testing :-for shell and cylinder, plate and bar and vacuum brazed cylinder and balance radiators, coolers and base centres. The office can give a full set-up of warmth exchanger warm execution testing, pressure drop assurance and warm appraisal trial of liquid to liquid warmth exchangers utilizing water and oil media. Liquid stream rates to 100 l/min oil and 400 l/min water or coolant can be conveyed to the test unit at different liquid temperatures and stream rates to completely describe a warmth exchanger for heat dispersal across its working reach. An average 25 to 30-point test lattice will give an itemized examination of any warmth exchangers warm execution. For air cooled heat exchangers in cooling plants, power age and plant cooling frameworks, the office houses two calorimetric air streams that can give controlled air to water and air to oil calorimetric testing. All test media stream rates, temperatures, pressures, mass streams or face speeds can be produced and controlled to close resilience to empower static and adjusted warmth dismissals to be finished. Air impact mass wind current rates to 6 kg/s can be produced and constrained through full face centre sizes up to 1 m2 and measure heat exchanger execution to 300 kW heat dismissal.

Naveenprabhu et al. [19],[20],[21],[23] and [24], stated that the heat transfer during the fluid movement and in the firing, places are crucial and heat transfer characteristics

is depends on the amount of fluid passed over the nozzle from the tank.

Naveenprabhu et al. [22] and [25], referred that during the running the pump the axle and the bearing will heated during the friction. That has to considered for the heat transfer of the heat to the machine.

Evaporative cooling will give you the better cooling to the machinery and the reduce the harm of the effect of firing. In order to improve firefighting characteristics we keep the machinery place cool by the different cooling methods [26],[27],[28] and [29].

6. CONCLUSION

The undertaking can lessen the quantity of heat exchangers utilized in ventures. The time and cost are saved. The project is created according to the plan. The testing of item was done. As an outcome the undertaking satisfied the point and objectives. This report unmistakably clarifies about the project from plan to completed item. To make a right material choice, a functioning information on the framework, heat exchanger plan, consumption designing, metallurgy and plant upkeep should be joined. The paper gives a system for making material choice. Normal instances of material determination for heat exchanger tubing of the thermal energy stations and condensers are brought out.

REFERENCES

[1] Rich DG. The effect of fin spacing on the heat transfer and friction performance of multi-row, smooth plate fin-and-tube heat exchangers. ASHRAE Trans 1973;79(1):137–45.

[2] Rich DG. The effect of the number of tube rows on heat transfer performance of smooth plate fin-and-tube heat exchangers. ASHRAE Trans 1975;81(1):307–17.

[3] McQuiston FC. Heat, mass, and momentum transfer data for five plate-fin-tube heat transfer surfaces. ASHRAE Trans 1978;84(1):266–93.

[4] McQuiston FC. Correlation of heat, mass, and momentum transport coefficients for plate-fin-tube heat transfer surfaces with staggered tubes. ASHRAE Trans 1978;109(1):294–308.

[5] Gray DL, Webb RL. Heat transfer and friction correlations for plate finned-tube heat exchangers having plain fins. In: Proceedings of eighth heat transfer conference; 1986. p. 2745–50.

[6] Seshimo Y, Fuji, M. An experimental study of the performance of plate fin and tube heat exchangers at low Reynolds number, In: Proceeding of the third ASME/JSME thermal engineering joint conference, vol. 4; 1991. p. 449–54.

[7] Wang CC, Hsieh YC, Chang YJ, Lin YT. Sensible heat and friction characteristics of plate fin-and-tube heat exchangers having plane fins. Int J Refrig 1996; 19:223–30.

[8] Rosman EC, Carajilescov P, Saboya FEM. Performance of one and two-row tube and plate fin heat exchanger. J Heat Transfer 1984; 106:627–32.41

[9] Wang CC, Chi KU. Heat transfer and friction characteristics of plain finandtube heat exchangers. Part I: New experimental data. Int J Heat Mass Transfer 2000; 43:2681–91.

[10] Wang CC, Chi KU, Chang CJ. Heat and friction characteristics of plain finandtube heat exchangers. Part II:

Correlation. Int J Heat Mass Transfer 2000; 43:2693–700.

[11] Madi AM, Johns RA, Heikal MR. Performance characteristics correlation for round tube and plate finned heat exchangers. Int J Refrig 1998; 21:507–17.

[12] Wongwises S, Chokeman Y. Effect of fin pitch and number of tube rows on the air side performance of herringbone wavy fin-and-tube heat exchangers. Energy Convers Manage 2005; 46:2216–31.

[13] Ma X, Ding G, Zhang Y, Wang K. Effects of hydrophilic coating on air side heat transfer and friction characteristics of wavy fin-and-tube heat exchangers under dehumidifying conditions. Energy Convers Manage 2007; 48:2525–32.

[14] Fiebig A, Grosse-Gorgemann Y, Chen Y, Mitra NK. Conjugate heat transfer of a finned. Part A: Heat transfer behavior and occurrence of heat transfer reversal. Numer Heat Transfer 1995; A28:133–46.

[15] Jang JY, Wu MC, Chang WJ. Numerical and experimental studies of threedimensional plate-fin-and-tube heat exchangers. Int J Heat Mass Transfer 1996; 39:3057–66. 42

[16] Leu JS, Wu YH, Jang JY. Heat transfer and fluid flow analysis in plate-finandtube heat exchangers with a pair of block shape vortex generators. Int J Heat Mass Transfer 2004; 47:4327–38.

[17] Mendez RR, Sen M, Yang KT, Clain RM. Effect of fin spacing on convection in a plate fin-and-tube heat exchanger. Int J Heat Mass Transfer 2000; 43:39–51.

[18] Huang JM, Hsieh WC, Ke XJ, Wang CC. The effects of frost thickness on the heat transfer of finned tube heat exchanger subject to the combined influence of fan types. Appl Therm Eng 2008; 28:728–37.

[19] NaveenPrabhu, V., SaravanaKumar, K., Suresh, T. and Suresh, M., 2016. Experimental investigation on tube-in-tube heat exchanger using nanofluids. Advances in Natural and Applied Sciences, 10(7 SE), pp.272-279.

[20] Justin Dhiraviam, F., Naveen Prabhu, V., Suresh, T. and Selva Senthil Prabhu, C., 2015. Improved efficiency in engine cooling system by repositioning of turbo inter cooler. In Applied Mechanics and Materials (Vol. 787, pp. 792-796). Trans Tech Publications Ltd.

[21] Naveen Prabhu, V. and Suresh, M., 2015. Performance evaluation of tube-in-tube heat exchanger using nanofluids. In Applied Mechanics and Materials (Vol. 787, pp. 72-76). Trans Tech Publications Ltd.

[22] Naveenprabhu.V. and Manigandan, N., 2014. Design and Fabrication of Solar Transport Vehicle. OSR J. Mech. Civ. Eng, 11, pp.14-19.

[23] Manigandan, N., NaveenPrabhu, V. and Suresh, M., 2015. Experimental investigation of a brazed chevron type plate heat exchanger. International Journal of Science Technology & Engineering, 1(12), pp.1-7.

[24] Dhiraviam, F.J., Naveenprabhu, V. and Santhosh, M., 2017. Study the Effects of Solar Assisted Vapour Compression Air Conditioning System for Winter Applications. International Journal for Scientific Research & Development, 4(11), pp.505-508.

[25] Manigandan, N., Naveenprabhu, V. and Devakumar, M., 2014. Design and Fabrication of Mechanical device for Effective Degreasing in Roller Bearing. Procedia Engineering, 97, pp.134-140.

[26] Pravin, V.N.D.M.K. and Swamy, V.R.S.S.A., A Review of Evaporative Cooling of Finned and Non-Finned Heat Exchanger on Condenser.

[27] Naveenprabhu, V. and Suresh, M., 2020. Performance enhancement studies on evaporative cooling using volumetric heat and mass transfer coefficients. Numerical Heat Transfer, Part A: Applications, 78(9), pp.504-523

[28] Dhiraviam, F.J., Naveenprabhu, V., Satish, K. and Palanivelrajan, A.R., 2019, October. Emission characteristic in CI engines using zirconium porous medium in piston head. In AIP Conference Proceedings (Vol. 2161, No. 1, p. 020012). AIP Publishing LLC.

[29] Naveenprabhu, V., Dhiraviam, F.J., Gowtham, K.M., Gowtham, S., Tharick, R.A. and Arunkumar, R., 2019. Smart Hot Chamber in Refrigeration System Based on Waste Heat Recovery. Indian Journal of Science and Technology, 12, p.20.

[30] Sureshbabu, Y., Ashokavarthnan, P., Balasubramani, S. and Naveenprabhu, V., 2019, October. Experimental investigation on four strokes catalytic coated spark ignition (SI) engine. In AIP Conference Proceedings (Vol. 2161, No. 1, p. 020041). AIP Publishing LLC.

[31] Ganeshkumar, S., Sureshkumar, R., Sureshbabu, M.Y. and Balasubramani, M.S., A Review of Performance Investigations in Hydrogen–Oxygen Generator for Internal Combustion Engines.

[32] Venkatesh, S., Sakthivel, M., Saranav, H., Saravanan, N., Rathnakumar, M. and Santhosh, K.K., 2020. Performance investigation of the combined series and parallel arrangement cyclone separator using experimental and CFD approach. Powder Technology, 361, pp.1070-1080.

[33] Kumar, S.D. and Kumar, S.S., 2020. Numerical and experimental ballistic performance of welded magnesium (AZ31B) plates. Emerging Materials Research, 9(4), pp.1217-1228.

[34] KUMAR, S.D. and KUMAR, S.S., 2021. Effect of heat treatment conditions on ballistic behaviour of various zones of friction stir welded magnesium alloy joints. Transactions of Nonferrous Metals Society of China, 31(1), pp.156-166.

[35] Venkatesh, S., Kumar, R.S., Sivapirakasam, S.P., Sakthivel, M., Venkatesh, D. and Arafath, S.Y., 2020. Multi-objective optimization, experimental and CFD approach for performance analysis in square cyclone separator. Powder Technology, 371, pp.115-129.

