BRAZED HEAT EXCHANGER BLOCK AND MANIFOLD AND METHOD FOR MAKING THEREOF

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ABSTRACT

The present invention relates to the field of automotive heat exchanger assemblies, and, in particular, block and manifold assemblies. The present invention also relates to a method of making a positive leak path to determine leaks prior to commercial employment of heat exchanger assemblies. The present invention further relates to a method of determining whether or not a leak seal is properly brazed by providing a positive leak path at the point of assembly or joint of a block and manifold.
FIG. 1

PRIOR ART
FIG. 2

PRIOR ART
FIG. 4

PRIOR ART
FIG. 9b

PRIOR ART
BRAZED HEAT EXCHANGER BLOCK AND MANIFOLD AND METHOD FOR MAKING THEREOF

FIELD OF INVENTION

[0001] The present invention relates to the field of automotive heat exchanger assemblies, and, in particular, block and manifold assemblies. The present invention also relates to a method of making a positive leak path to determine leaks prior to commercial employment of heat exchanger assemblies. The present invention further relates to a method of determining whether or not a leak seal is properly brazed by providing a positive leak path at the point of assembly or joint of a block and manifold.

BACKGROUND OF THE INVENTION

[0002] Automotive heat exchanger assemblies commonly use block connection points for the inlet and outlet of refrigerant, oil, or other fluids. The manifold or, in some applications called the header, serves as a receiving area or tank for the tube elements of common heat exchangers. Use of a block to allow fluid to flow from the connecting lines through to the internal portion of the manifold is commonly used. The area of contact of block and manifold is typically referred to as a 'joint.'

[0003] There are three typical designs for a connecting joint that surrounds an aperture that allows fluid to pass. The first is to have a cylindrical machined area that passes through an aperture or passageway in the manifold. This type of connection creates a brazed seal directly between the cylindrical section of the block and the manifold. U.S. Pat. No. 5,711,370 (Hiroshi Tanaka) issued Jan. 27, 1998, shows an example of this type of connection.

[0004] A second type of design does not have a cylindrical portion, but rather seals to the manifold by brazing a semi-circular cross-section to the mating section of the manifold. U.S. Pat. No. 5,685,364 (Matthew K. Harris) issued Nov. 11, 1997, U.S. Pat. No. 5,664,432 (Stephen W. O’Brien) issued on Sep. 9, 1997, and European Patent 0821213B1 (assigned to Calsonic Corp) show examples of this type of connection.

[0005] A third type of design uses a small stamped or machined insert that is pressed into the aperture in the block. The insert is used to hold the block to the manifold until the brazing process can take place.

[0006] In both the second and third design types a seal exists between the block and the manifold wherein the 'semi-circular' section of the block brazes to the mating section on the manifold creating the seal. U.S. Pat. No. 5,240,068 (Toshinori Tokutake) issued on Aug. 31, 1993, shows an example of this type of connection, and is incorporated by reference herein.

[0007] U.S. Pat. Nos. 4,372,374A and 6,192,583, in addition to European Patent Application 571263A1, describe attempts to control and direct fluids that may lead from a brazed assembly. In the case where two separate fluids that cannot be mixed in a heat exchanger, a leak path is created so that any fluid leak does so into the atmosphere, and not into the other fluid.

[0008] In the past, heat exchangers have been subject to testing and provided with means to detect improper manifold end cap brazing, as in Japanese Patent Application JP10197188A. However, positive leak paths to detect leaks in joints between a block and manifold in a heat exchanger have not been described in any of these documents.

SUMMARY OF THE INVENTION

[0009] The present invention relates to a connecting block and manifold combination wherein a deformation or other surface feature, such as a hole, is present to allow fluid to pass from the manifold into the connecting block. The present invention further relates to a method of making a positive leak path to determine leaks prior to final shipment of quality-verified heat exchanger assemblies.

[0010] Another aspect of the present invention is that it allows the creation of a positive leak path that will seal if the block and manifold is properly brazed, but will consistently leak at the leak test machine should the block and manifold assembly brazed improperly. The present invention results, thereby, in markedly better detection of 'non-conforming' or 'leaking' heat exchanger assemblies, especially block and manifold assemblies, by reducing or eliminating the occurrence of 'non-conforming' of 'leaking' assemblies reaching the customer in less than optimal condition for performance.

[0011] The present invention, therefore, preferentially provides a means for prohibiting a 'complete' or 'overall' brazing that allows for fluid leakage via a positive leak path, comprising, for example, at least one deformation, perforation, cut-out, hole or the like. The means is located in the heat exchanger assembly, connecting block, the manifold, or in the insert, or if one or more such a means is employed, in any combination of the above. When the assembly is tested, and, particularly, leak tested, any area that might appear sealed by an 'interference fit' or 'press fit' interference or by other means (temporary seal) (whereby, for example, material left over in the brazing process may cause the false impression of a 'permanent' braze sealing), will be bypassed, and the block and manifold assembly can be properly evaluated for 'permanent' sealing. A permanent seal is, therefore, a seal which is designed to withstand pressure, temperature, chemical and/or other conditions encountered during the expected, normal 'lifetime' of the product, (e.g. the life of such a seal demanded by the specifications applicable for a vehicle using a heat exchanger). A 'temporary' seal is, therefore, a seal usually inadvertently produced that would not be designed for and/or expected to last the lifetime of the product. The present invention solves the problem of detecting temporary seals, and, in particular, undesirable seals which may lead to false positive results and resultant failures of assemblies due to non detection of potential undesired future leakages. Therefore, a positive leak would indicate the presence of an incorrect or improperly located brazing that does not adequately seal or temporarily seals at the block and manifold joint area. When an insert is employed, as in preferred embodiments of the present invention, the present invention also allows for a means for detecting temporary seals or potential future leaks caused by an 'incorrect' brazing process, by providing for a standard connecting aperture and at least one means for prohibiting a complete brazing such as deformation, hole, perforation, cut-out, modification or the like, either in the connecting block or in the manifold of the heat exchanger, or in the insert, so that when the assembly is tested, and, particularly, leak tested, any area that might
The present invention provides for block and manifold assemblies for heat exchangers whereby defective or ‘temporarily sealed’ assemblies, that might normally pass ordinary leak tests used in the industry, can be detected and contained within the manufacturing plant, reducing or eliminating customer returns.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic representation of a block and connecting manifold used in a heat exchanger assembly in accordance with an aspect of the present invention.

FIG. 2 is a schematic representation of a cross-section of block with cylindrical braze connection to manifold.

FIG. 3 is a schematic representation of a cross-section of block with semi-circular braze joint only.

FIG. 4 is a schematic representation of a cross-section of block with press-fit insert, and semi-circular braze joint.

FIG. 5 is a schematic representation of a block and connecting manifold only with standard connection aperture of the prior art.

FIGS. 6a and 6b are a schematic representation of a block and connecting manifold with aperture modified to provide leak path(s) (8), in accordance with an aspect of the present invention.

FIG. 7 is a schematic representation of a block and connecting manifold of the prior state of the art block, with press-fit insert (3).

FIG. 8 is a schematic representation of a block and connecting manifold block with added cut-out (9) to allow for leak path, in accordance with an aspect of the present invention.

FIGS. 9a and 9b are schematic representations of a block and connecting manifold insert representing prior state of the art.

FIGS. 10a and 10b are schematic representations of a block and connecting manifold insert with gap (12) to allow for leak path, in accordance with an aspect of the present invention.

FIG. 11 is a perspective representation showing, in a disassembled state, parts of a heat exchanger, without corresponding block with connecting aperture.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention relates to a heat exchanger assembly which detects temporary seals comprising a block; a manifold; and a means for detecting temporary seals between the block and the manifold. Preferably the means is located on the block, insert or the manifold. More preferably the means is located on the block, insert or manifold, or on a combination of the above. The means for detecting temporary seals is, preferably, a means that prohibits a complete brazing at the manifold to block joint. The means for prohibiting a complete brazing, as described above, my be located on the block, the manifold or the insert. The means for prohibiting a complete brazing, may, preferably, consist of a deformation, perforation, cut-out, hole or the like. The means may consist of more than one deformation, perforation, cut-out, hole or the like. When the means consists of more than one deformation, perforation, cut-out, hole or the like, the deformations, perforations, cut-outs, holes, or the like, they may all be located on the manifold, block, or insert, or they may be located on the manifold and block, manifold and insert, block and insert, or any combination of the above. Preferably the means for prohibiting a complete brazing having more than one deformation, perforation, cut-out, hole or the like, have the deformations, perforations, cut-outs, holes or the like formed and so that braze material can not fill the space and create a seal. In other preferred embodiments, the means for

As described above, the means for prohibiting a complete brazing, in accordance with the present invention, may consist of many different modifications, deformations, perforations, cut-outs, holes or the like, in the manifold, to the aperture in the manifold. The means may be of almost any shape, for example, it may be circular or square, oval, rectangle, triangle, or virtually any other shape. The means for prohibiting a complete brazing is thereby accomplished by virtually any shaped ‘means’, as long as the overall shape of the means, such as a hole, differs or does not match up or is not following the contours of (complementary with) the general form of the insert (3) well enough to form a complete braze joint where the manifold (1) and block (2) assembly parts interface (5).

In another embodiment of the present invention, one or more cutouts (9) to the block (2) are made so that fluid can leak past the press fit (4) of the insert (3) allowing detection in a leak test machine.

In a further embodiment of the present invention, to ensure that the overall shape of the aperture differs or does not match up with the general form of the means for prohibiting a complete brazing, the insert may be modified in shape. Preferably, a ‘gap’ or ‘space’ (12) to the insert is made (11) so that it bypasses the press fit, allowing for leak detection (FIGS. 10a and 10b). Also, preferably, the shape of the insert may be modified from a generally circular one to one that does not match the shape of the aperture in the manifold (3). The new shape of insert, as found in preferred embodiments of the present invention, may be virtually any shape, as long the lack of complementarity provides for a large enough ‘gap’, deformation, or the like, so that a space is formed and so that braze material can not fill the space and create a seal. In other preferred embodiments, the means for
prohibiting a complete brazing may exist in the block, the manifold, or in a combination of the above.

[0029] As described above, when a block connection, such as that described in FIGS. 4, 15 and 16 hereinabove, is to be assembled with the manifold, there can be instances where the outer diameter of the insert (3) can ‘temporarily’ seal to the inner diameter of the block (4) due to press fit interference or due to the inadvertent presence of other materials or residues, such as flux, or other materials or chemicals. If the main joint between the block and the manifold (6) does not properly braze and the joint between the insert and the manifold (5) does braze, the part will pass normal leak testing procedures, but will begin to leak later, and, potentially, at the customer interface level, as the press fit loosens.

[0030] The cut-outs of FIG. 6h are examples of one of the means of detecting temporary seals in accordance with an aspect of the present invention.

[0031] FIG. 11 shows one side of a heat exchanger comprising a plurality of tubes (21), a plurality of fins (22) between the tubes, a manifold (24), a body (A), an aperture (211) and side plates (212), prior to addition of the means of detecting temporary seals of the present invention.

[0032] The present invention also provides for a method for detecting temporary seals, such as inappropriate or incomplete seals, in heat exchanger assemblies. In a preferred method, the steps comprise providing a means for allowing fluid passage between a manifold and a block via a hole; passing a brazing fluid through said passage; providing a positive leak path comprising a means for detecting temporary seals in the connecting block manifold or insert of the heat exchanger assembly; and thereby, testing for positive leaks. In preferred methods of the present invention, the area around the aperture is incorrectly or incompletely brazed, thus allowing for the temporary seal detecting means to show leaks of fluids being used for the testing cycle.

What is claimed is:

1. A heat exchanger assembly which detects temporary seals comprising:
   a block;
   a manifold; and
   a means for detecting temporary seals between the block and the manifold.
2. A heat exchanger assembly as in claim 1 wherein said means is located on the block or the manifold.
3. A heat exchanger assembly as in claim 2 wherein said means for detecting temporary seals comprises a means for prohibiting a complete brazing.
4. A heat exchanger assembly as in claim 3 wherein said means for prohibiting a complete brazing is located on the block.
5. A heat exchanger assembly as in claim 3 wherein said means for prohibiting a complete brazing is located on the manifold.
6. A heat exchanger assembly as in claim 1 further comprises an insert.
7. A heat exchanger assembly as in claim 6 wherein said means for detecting temporary seals comprises a means for prohibiting a complete brazing.
8. A heat exchanger assembly as in claim 7 wherein said means for prohibiting a complete brazing is located on the insert.
9. A heat exchanger assembly as in claim 2, wherein the means consists of more than one deformation, perforation, cut-out, hole or the like.
10. A heat exchanger assembly as in claim 7, wherein the means consists of one or more, deformations, perforations, cut-outs, holes, or the like.
11. A heat exchanger assembly as in claim 1, wherein the means consists of one or more deformations, perforations, cut-outs, holes or the like.
12. A method for detecting temporary seals in heat exchanger assemblies comprising:
   providing a means for allowing fluid passage between a manifold and a block via a hole;
   passing a brazing fluid through said passage;
   providing a positive leak path comprising a means for detecting temporary seals in the connecting block manifold or insert of the heat exchanger assembly;
   testing for positive leaks.

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