

MGT Inc.

October 24, 2001

Subject: Letter Report No. 312.1

Mr. James P. Berneski
Expansion Seal Technologies
334 Godshall Drive
Harleysville, PA 19438-2008

Dear Mr. Berneski:

I am pleased to submit herewith our report No. 312.1, "Evaluation of High Lift Flange Weld/Test Plugs (HLFW/TP).

As you requested, I examined the 2-inch 150# High Lift Flange Weld Test Plug (HLFW/TP) that you provided along with EST's standard welding plug operating instructions consisting of 4 pages. In addition, I downloaded from the EST website the pages that discuss the use of the device.

The purpose of my examination was to form and express opinions about its quality, utility in testing and repairing boiler parts, parts of unfired pressure vessels, process and power piping, and its acceptability to the following codes:

The ASME Boiler and Pressure Vessel Code, 2001 Edition
Section I Rules for Construction of Power Boilers
Section V Nondestructive Examination
Section VIII Division 1 Rules for Construction of Unfired Pressure Vessels
Section VIII Division 2 Alternative Rules for Construction of Pressure Vessels
The ASME Code for Pressure Piping B31
B31.1 2001 Edition, Power Piping
B31.3 1999 Edition and Addenda B31.3a-2000 and B31.3b-2001 Process Piping
The National Board Inspection Code 1998 Edition and 1999 and 2000 Addenda
API-510 7th Edition March 1992 and 1997 and 1999 Errata

Because the B31.1 2001 Edition of Power Piping will not be available until some time in November, I have not performed a detailed evaluation with respect to it. I will supplement Report 312.1 when I receive the Power Piping Code.

After examining the specimen that EST provided and studying the documents listed above, I have following opinions.

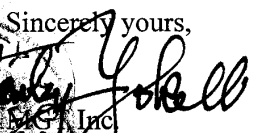
1. The quality of manufacture of the specimen I examined is excellent.
2. The EST HLFW/TP is very useful for verifying the structural integrity of flanges and gasket surfaces. For this purpose, it meets specific and implied requirements of the documents referred to above.

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3. The EST HLFW/TP provides a means of venting air and non-condensable gases, draining residual liquid, filling with test medium and pressure testing discrete regions and parts to ANSI B16.5 without the need to fill the whole structure.
4. Because the EST HLFW/TP is bolted to the flange of the structure to be tested, it is safe to use. Inadvertent increases in upstream pressure will not expel the plug and expose personnel to injury.
5. During construction and repairs, the EST HLFW/TP may be used to test parts of boilers built to ASME Code Section 1 hydrostatically without testing the whole structure.
6. In Section VIII of the ASME Boiler and Pressure Code, when a flanged connection tested in accordance with UG-99 or UG-100 of Division 1 and AT-355 or AT-300 of Division 2 leaks, it must be repaired. The EST HLFW/TP may be used to isolate the failure purging test water or relieving test air, retain gas backing and pressure test the part.
7. The EST HLFW/TP is suitable for testing, flanges, long welding necks, flanged joints and fabricated or repaired flanged piping to the limit of the test capability of ASME B16.5 PN 420 (Class 2500 rating flanges). For this purpose, it meets the requirements of Normal Fluid Service and Category D without exception. It meets the requirements of Category M during fabrication and when making repairs when no hazardous fluids are present. Such testing may be done on the affected region without the necessity of testing the whole structure.
8. The EST HLFW/TP meets the testing requirements of the National Board Inspection Code and API-510 for testing parts after repairs and/or alterations. If the part can be isolated using the EST HLFW/TP, the whole vessel need not be tested after repairing or altering the part.

Although I have not received the B31.1 2001 Edition, Power Piping, I have no doubt that the EST HLFW/TP can be used in similar fashion to its use in testing as required in the B31.3 2001 Edition, Process Piping. Upon receipt of B31.1, I will verify this opinion.

Sincerely yours,



MGT Inc.
Stanley Yokell, P. E.,
Fellow of the ASME
President



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MGT Inc. Letter Report No. 312.1 Revision 0

Client: Expansion Seal Technologies

Location: 334 Godshall Drive
Harleysville, PA 19438-2008
USA

Client Purchase Order No: 110142

Title: Evaluation of High Lift Flange Weld/Test Plugs (HLFW/TP)

Client Engineer: James P. Berneski

By: Stanley Yokell, P.E., Fellow of the ASME, President, MGT Inc.

Date: October 24, 2001

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GENERAL INFORMATION

The following paragraphs identify the companies and individuals party to this work/action.

Companies

Expansion Seal Technologies (EST)
MGT Inc. (MGT)

Client
Consultant

Personnel

James P. Berneski, Engineer (Berneski)
Stanley Yokell, MGT Consultant (Yokell)

CLIENT-PROVIDED MATERIAL

EST provided a specimen High Lift Flange, 2-inch 150# with maximum test pressure capability of 450 psi and EST's standard welding plug operating instructions consisting of 4 pages.

PURPOSE OF THIS REPORT

The purpose of this report is to evaluate the suitability of EST HLFW/TPs for use with and conformity to the requirements of various safety, inspection and repair codes.

PRESSURE VESSEL AND PRESSURE PIPING CODES COVERED BY THIS EVALUATION

The codes covered by this evaluation are:

The ASME Boiler and Pressure Vessel Code, 2001 Edition
Section I Rules for Construction of Power Boilers
Section V Nondestructive Examination
Section VIII Division 1 Rules for Construction of Unfired Pressure Vessels
Section VIII Division 2 Alternative Rules for Construction of Unfired Pressure Vessels
The ASME Code for Pressure Piping B31
*B31.1 2001 Edition
B31.3 1999 Edition and Addenda B31.3a-2000 and B31.3b-2001
The National Board Inspection Code 1998 Edition and 1999 and 2000 Addenda
API-510 7th Edition March 1992 and 1997 and 1999 Errata

* As of the date of this report, this publication is not available. ASME has advised that it will be available in November 2001. At that time, a supplement to this report will be provided.

DISCUSSION



Figure 312.1 EST 2" High Lift Flange Weld Test Plug Assembly



Figure 312.2 EST 2" High Lift Flange Weld Test Plug Disassembled

The HLFW/TP consists of a pipe flange that is sealed to one end of a hollow shaft and a urethane sealing element at the other end. The sealing element is sandwiched between by two washers. The sealing element and washers are sized to enter with clearance the pipe to be tested or joined to another section by welding. A segmented compression tube separates the flange and sealing element. The hollow pipe shaft is threaded at each end. A jam nut and hex nut locks the urethane element into firm contact with the compression tube. Figure 312.1 shows an assembled 2-in. HLFW/TP. Figure 312.2 shows the HLFW/TP disassembled.

Depending upon the size of the tool, the position of the urethane element is adjusted by means of a fixed compression member and nut or a removable compression tube positioned between the side of the flange that is not gasketed and a hex nut threaded onto the hollow shaft.

This construction effectively seals a discrete region of a pipe or tube that has a flange on one end. In addition to the construction described above, the bolting flange or attachment to it has two tapped and plugged holes, which the EST instructions label vent port and fill port.

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Use for Testing Flange and Gasket Surface Integrity

This tool is very useful for verifying the structural integrity of flanges and gasket surfaces.

Use as a Test Plug

When the HLFW/TP is used as a test plug, it enables venting air or other non-condensable gas, draining any residual liquid, filling with test medium and pressure testing to ANSI B16.5 requirements the sealed-off region without filling the whole structure. During such testing, the threaded hollow shaft enables the user to monitor the downstream conditions.

Use in Welding

The HLFW/TP is designed to use during attaching a flange to a pipe to enable inert gas purging during welding of the girth seam, and longitudinal seams in the contained region and subsequent venting the gas, filling with test medium and pressure testing. The seal isolates the area to be welded from combustible gases or vapors.

EVALUATION

I have read EST's literature and examined the specimen HLFW/TP in order to evaluate its quality, and the utility of the device and applicability to the codes listed above. In my opinion, the EST HLFW/TP is a high quality and worthwhile tool suitable for use with all of the listed codes, subject to the exception listed for M category piping in B31.3. I believe that properly applied, the HLFW/TP will facilitate leak and pressure-testing of pressure retaining items and parts and repairs and alterations to such items and parts at a considerable cost saving over the cost of testing complete assemblies. Following are details of the evaluation I have conducted that are the basis of my opinion.

General

Because the high lift flange weld test plug is bolted to the flange that is being tested, an inadvertent increase in upstream pressure will not displace or expel installed plugs.

The use of this tool will not damage the flange, the pipe or the flange-to-pipe connection.

Quality

EST's literature states that they manufacture HLFW/TPs the under a Quality Assurance Program certified to ISO 9001 and U. S. nuclear industry standards that include ANSI N45.2, NQA-1, 10CFR 50 Appendix B and 10CFR 21. The quality of the specimen HLFW/TP that I examined is of a very high and satisfactory order and, in my opinion, substantiates adherence to these standards.

Evaluation for Use with the ASME Code

Section 1 Power Boilers

Paragraph PW-54. Paragraph PW-54 describes requirements for hydrostatic testing of welded drums and other welded pressure parts. It requires retesting in the regular way after repairs if the drum or part fails the hydrostatic test. Where the failure is in a flanged part (flange, weld, and pipe), the HLFW/TP is suitable for isolating the failure, purging test water, retaining gas backing (if used) and pressure testing. This endeavor can be performed without the necessity of draining the whole structure to permit welding and hydrostatically testing the whole drum or part.

Section VIII Division 1 Unfired Pressure Vessels

Paragraphs UG-99 and UG-100. Paragraph UG-99 describes requirements for hydrostatic testing unfired pressure vessels built to the rules of Division 1. Paragraph UG-100 describes requirements for pneumatic testing of such unfired pressure vessels. Leakage is not permitted during visual inspection. A manufacturer who finds leakage must make a repair that is acceptable to the Authorized Inspector and retest to demonstrate that there is no leakage. Where the failure is in a flanged part (flange, weld, and pipe), the HLFW/TP is suitable for isolating the failure, purging hydrostatic test water or venting pneumatic pressure, retaining gas backing (if used) and pressure testing. To perform this endeavor it is not necessary to drain the whole vessel to permit welding and hydrostatically retesting the joint that leaked. It is necessary to relieve the pneumatic pressure.

Section VIII Division 2 Unfired Pressure Vessels Alternate Rules

Paragraphs AT-300 and AT-355. Paragraph AT-300 describes requirements for hydrostatic testing unfired pressure vessels built to the rules of Division 2. Paragraph 355 describes requirements for pneumatic testing of such unfired pressure vessels. Leakage on testing during visual inspection is not permitted. A manufacturer who finds leakage must make a repair that is acceptable to the Authorized Inspector and retest in accordance with ATT-400 to demonstrate that there is no leakage. Where the failure is in a flanged part, the HLFW/TP is suitable for isolating the failure, purging hydrostatic test water or venting pneumatic pressure, retaining gas backing (if used) and pressure testing. To perform this endeavor it is not necessary to drain the whole vessel to permit welding and hydrostatically retesting the joint that leaked. It is necessary to relieve the pneumatic pressure.

Evaluation for Use with the ASME Code for Pressure Piping, B31.1 Power Piping 2001 Edition

The Power Piping Code is a Section of the American Society of Mechanical Engineers Code for Pressure Piping, ASME B31, an American National Standard. ASME publishes it as a separate document for the convenience of Code users.

This evaluation will follow after the 2001 edition becomes available from ASME.

Evaluation for Use with the ASME Code for Pressure Piping, B31.3 Process Piping 1999 Edition and Addenda B31.3a-2000 and B31.3b-2001

The Process Piping Code is a Section of the American Society of Mechanical Engineers Code for Pressure Piping, ASME B31, an American National Standard. ASME publishes it as a separate document for the convenience of Code users. The rules of the code have been developed considering piping typically found in petroleum refineries; chemical, pharmaceutical, textile, paper, semiconductor, and cryogenic plants; and related processing plants and terminals.

This evaluation covers only those parts of B31.3a-2000 and B31.3b-2001 that apply to metallic piping. To evaluate the HLFW/TP for use with B31.3 it is necessary to examine its suitability for fluid services defined in paragraph 300.2 Definitions.

300.2 defines *fluid service* as a general term concerning the application of a piping system, considering the combination of fluid properties, operating conditions, and other factors which establish the basis for the design of the piping system and defines types of fluid service. It defines specific services as follows.

Normal Fluid Service: a fluid service pertaining to most piping covered by this Code, i.e., not subject to the rules for Category D, Category M, or High Pressure Fluid Service.

Category D Fluid Service: a fluid service in which all the following apply: (1) the fluid is nonflammable, nontoxic and not damaging to human tissues as defined in para. 300.2; (2) the design gage pressure does not exceed 1035 kPa (150 psi); and (3) the design temperature is from -29 °C (-20 °F) through 186 °C (366 °F).

Category M Fluid Service: a fluid service in which the potential for personnel exposure is judged to be significant and in which a single exposure to a very small quantity of toxic fluid, caused by leakage can produce serious irreversible harm to persons on breathing or bodily contact, even when prompt restorative measures are taken.

High Pressure Fluid Service: a fluid service for which the owner specifies the use of Chapter IX for piping design and construction. K300 of Chapter IX pertains to piping that the owner designates as being in High Pressure Fluid Service. Its requirements are to be applied in full to piping so designated. High pressure is considered in Chapter IX to be pressure in excess of ASME B16.5 PN 420 (Class 2500 rating) for the specified design temperature and material group. However, there are no specified pressure limitations for the application of the rules of Chapter IX.

Applicability of High Lift Flange/Weld Test Plug for Normal Fluid Service. HLFW/TP is eminently suitable for testing flanged joints and fabricated or repaired flanged piping used in Normal Fluid Service to the limit of the test capability of ASME B16.5 PN 420 (Class 2500 rating) flanges.

Applicability of High Lift Flange/Weld Test Plug for Category D Fluid Service. The HLFW/TP is eminently suitable for testing flanged joints and fabricated or repaired flanged piping used in Category D Fluid Service.

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Applicability of High Lift Flange/Weld Test Plug for Category M Fluid Service. In my opinion, the high lift flange/weld test plug is suitable for testing during fabrication and after repairs when no hazardous materials are present. The standard HLFW/TP is not acceptable for testing flanged joints and repaired flanged piping used in Category M Fluid Service during operation.

Applicability of High Lift Flange/Weld Test Plug for High Pressure Service (Greater than 9375 psi). Expansion Seal Technology's standard product line does not include HLFW/TPs for High Pressure Service. However, subject to pressure, temperature and process fluid, Expansion Seal Technologies will produce HLFW/TPs for High Pressure Fluid Service above the limits of test pressures of ASME B16.5 PN 420 (Class 2500 rating) flanges on special order. Prospective users should negotiate conditions and commercial matters with EST. Such specially produced test equipment should be thoroughly pretested before use.

Flange Design. The pressure design of the HLFW/TPs for use with normal service and Category D service conform with the requirements of 304.5 Pressure Design of Flanges and Headers. When using HLFW/TPs during joining a flange to a pipe or testing, the standard distance between the flange and washer/seal assembly is set at approximately 12-in. However, Users may special order a HLFW/TP to any practicable straight length of pipe. It is essential that Users follow the operating instructions provided with each device for safe and successful use of the device.

Users should use the ported center shaft to monitor the pressure and composition of the material in the line beyond the washer-seal assembly during use. Where the pressure beyond the washer-seal assembly is higher than inert gas backing pressure, Users have the capability of monitoring the gas outlet composition.

Fabrication and Repairs. The HLFW/TP provides a means for providing the required flow of inert gas where inert gas backing is used during assembly and/or repairing single butt-welded joints, welded from the outside. EST did not design the HLFW/TP as an alignment device. Manufacturers must use other means to establish alignment in conformity to 328.4.3.

The HLFW/TPs applicability is limited to use in joining pipe to flanges and long welding necks. (See Fig. 328.5.2B (3)).

Where weld repairs made in accordance with 328.6 require preheat or post-weld heat treatment, the HLFW/TP may be used only if the positions of the o-ring seal and washer-seal assembly are such that the sealing elements will not be damaged.

Test Capabilities. The design of the EST High Lift Flange/Weld Test Plugs is well suited for gas-leak and hydraulic testing longitudinal joints of isolated, flanged sections of process piping welded by any of the means listed in Table 302.3.4. The plug's applicability is not restricted to testing joints to pipe of welding-neck flanges, long welding necks, and socket welding flanges. It may be used with any of the configurations of Fig. 328.5.2B. There is no impact of the procedure used to produce welds for fabrication and/or repair process piping on the utility of the HLFW/TP.

345 has the requirements for leak testing. 345.1 requires testing the completed piping system to ensure tightness. The HLFW/TP is not designed for testing the completed system. However, 345.2.3 Special Provisions for Testing sub-paragraph (a) states, "Piping subassemblies may be tested either separately or as assembled piping." Therefore, the HLFW/TP may be used for the purpose of testing joints of flanges to piping and lengths of piping in lengths between the flange and washer-seal assembly in Normal Fluid Service and for Category D assemblies. Owners who

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exercise the option of subjecting Category D assemblies to an initial service leak test in accordance with 345.7 (The process fluid is the test fluid.) must verify with EST that the process fluid and sealing elements are compatible. Subject to the limitations of 345.2.3, the HLFW/TP is suitable for use in pneumatic testing in accordance with 345.5 and hydrostatic-pneumatic testing in accordance with 345.6. The HLFW/TP is also suitable for preliminary pneumatic leak testing in accordance with 345.2.1 (c).

Within the pressure limitations of EST's ability to produce custom HLFW/TPs for pressures in excess of ASME B16.5 PN 420 (Class 2500 rating) for the specified design temperature and material group pressures, the HLFW/TP is acceptable for testing in conformity with the requirements of K345.

Evaluation for Use with the the National Board Inspection Code 1998 Edition and 1999 and 2000 Addenda (NBIC)

Paragraph RB-3431c requires piping to be inspected to ensure there is no evidence of leakage. Within the category and pressure limitations of ASME B31.1 and 31.3, the HLFW/TP may be used to determine that components exhibit no leakage. Part RC covers Repairs and Alterations. RC-1120 requires Authorized Inspectors (AIs) to witness any pressure tests. The HLFW/TP pressure is useful for efficiently testing tightness of pressure retaining parts that have been repaired or altered on boilers, pressure vessels and piping systems into which it can fit. In my opinion, it is acceptable to test such pressure retaining parts without the need to test the complete boiler, pressure vessel or piping system.

RC-2051 describes testing methods that apply to repairs and replacement parts used in repairs based on the nature and scope of the repair activity. These include liquid pressure testing, pneumatic testing, initial service leak testing and vacuum testing. In my opinion, it is acceptable to perform such testing with the HLFW/TP as applicable to the configuration.

RC-3030 describes testing methods that apply to all alterations of pressure retaining items based on the nature and scope of the repair activity. These include liquid pressure testing and pneumatic testing. In my opinion, it is acceptable to perform such testing with the HLFW/TP as applicable to the configuration.

Evaluation for Use with API-510 7th Edition March 1992 and 1997 and 1999 Errata


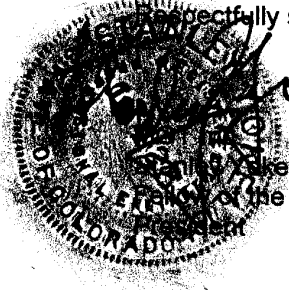
Section 4 of API-510 Paragraph 4.4 states, "When the API authorized pressure vessel inspector believes that a pressure test is necessary or when, after certain repairs, the inspector believes that one is necessary, the test shall be conducted in accordance with the construction code used for determining the maximum allowable working pressure." It allows pneumatic testing but requires considering the risks involved. Section 5 Paragraph 5.2.9 states, "After repairs are completed, a pressure test shall be applied if the API authorized pressure vessel inspector believes that one is necessary. A pressure test is normally required after an alteration." API-510 allows the API authorized inspector considerable leeway in determining when a pressure test is required.

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When it is necessary to perform a repair or to alter a flanged nozzle, using the HLFW/TP facilitates using a welding process for butt welds that uses inert gas backing. Using the HLFW/TP to hydrostatically or pneumatically pressure test the girth welds of the post-repaired or post-altered connection should satisfy the requirement for testing without the time consuming effort to seal all openings and fill the pressure vessel.

Respectfully submitted,

Paul D. Skell, P.E.,
Member of the ASME