



Heat Exchangers Division  
Chart Industries, Inc.

2191 Ward Avenue  
La Crosse, WI 54601 USA  
Phone: 608.787.3333 Fax: 608.787.2141  
www.altec-intl.com

This letter certifies that the Core as identified has been cleaned and inspected for oxygen services per Chart Standard Engineering Specification Section 9 No. 9-14.00.

Sales Order 509.2-3 Core No. \_\_\_\_\_  
National Board No. 5068 Core Serial No. 509.1-1  
5069 509.1-2  
Chart Inspector Ed H  
Date Inspected 2-12-05

CHART HEAT EXCHANGER L.P.

QUALITY DEPARTMENT

- (1) Attach White Original to Core Nameplate
- (1) One Copy to Quality Files



America

**Inspection Body of TÜV Industrie Service  
GmbH TÜV Süd Gruppe  
Notified Body ID No. 0036,  
to Directive 97/23/EC**



Industrie Service

**Report on the Final Assessment  
in accordance with Annex I, Section 3.2 of Directive 97/23/EC**

Customer:	Chart Heat Exchangers	Page:	1 of 3
Manufacturer:	Chart Heat Exchangers	Report No.:	P-USA-05-02-14-006
	2191 Ward Ave		Rev. 1
	La Crosse, WI 54601, USA	Certificate No.:	USA 05/03/14/019
			USA 05/03/14/020
Equipment Type:	Aluminum Plate Fin Heat Exchanger		

**Test / Inspection Specification:** Directive 97/23/EC for Pressure Equipment, Module B+F  
Applied code / standard: ASME Section VIII Div. 1, 2001 edition, 2003 addenda

**Marking / Labeling of the pressure equipment:**

Marking on: Nameplate

- Manufacturer's name and / or identification: Chart Heat Exchangers L. P.
- Year of manufacture: 2005
- Type / Serial number: 509.1-1 and 509.1-2
- Intended Use: Cryogenic Gas Service

**Other identification information:**

Chamber Designation:	A	B	--
Min./Max. allowable pressure PS [bar]:	0 / 7.5	atmospheric	
Min./Max. allowable temperature TS [°C]:	-196/65	-196/65	
Volume V [Liter]:	2345	2132	
Fluid:	Group 1	--	

**EC-Type-examination on:** February 01, 2005 and March 17, 2005 (revised)  
by: Inspection Body of TÜV Industrie Service GmbH TÜV Süd Gruppe, Report No. P-USA-05-02-14-004 Rev. 1  
Module: B

Drawing / Document number or similar designation:

- 15772A Rev. B
- 15772B Rev. A
- 15772C Rev. E
- 15772Z Rev. B
- 15772NPCE Rev. 0

The documents were presented and are valid.

**Final Assessments** in accordance with Annex I Section 3.2.1 of the Pressure Equipment Directive on:  
February 10, 2005  
by: Inspection Body of TÜV Industrie Service GmbH TÜV Süd Gruppe.

**Inspections and examinations and their results:**

- The calibration labels showed that the inspection / measuring / test equipment used for the inspections was calibrated.
- The material certificates for the main pressure-bearing parts were presented and comply with the requirement.
- Evidence of the required qualifications of employed joining personnel and NDT-personnel was presented and is valid.
- Evidence of the required qualification of joining procedures was presented and is valid.



America

Inspection Body of TÜV Industrie Service  
GmbH TÜV Süd Gruppe  
Notified Body ID No. 0036,  
to Directive 97/23/EC



Industrie Service

Report No.: P-USA-05-02-14-006 Rev. 1 Page: 2 of 3

**Final Assessment** in accordance with Annex I Section 3.2.1 of the Pressure Equipment Directive (continued):

- Random visual inspection and dimensional checks were performed by the manufacturer and the Notified Body: Visual inspection of the main weld seams (e.g. header seams); dimensional check of the main components (core, heads). There were no objections.
- Implemented procedures to ensure traceability were reviewed and checked at random. There were no objections.
- Deviations from, amendments to or restrictions of the test / inspection specification: None
- Non-standardized test processes and procedures that were used: None
- Other documentation submitted by the manufacturer (title and/or unique identification): None

**Proof (Pressure) Tests** in accordance with Annex I Section 3.2.2

on: February 10, 2005

by: Inspection Body of TÜV Industrie Service GmbH TÜV Süd Gruppe

Chamber Designation:	A	B	--
Test Pressure (bar):	11.3	--	
Pressure Test Medium:	Air/N <sub>2</sub>	--	

**Conclusion:** The Final Assessment was performed in compliance with the requirements of the Directive. The performance of the inspections / tests and their results showed no deviations.

**Remarks:**

- The test results cover only the tested equipment described here.
- A partial duplication of the test results without the written consent of the Notified Body is not permitted.

**Based on the performed tests and inspections, and after approval by the Certification Body, there are no objections to affixing the CE marking and the identification number 0036.**

**Additional Notes:**

- The pressure equipment was tested and inspected without constituent parts. Therefore, the testing and inspection of the constituent parts is still necessary.
- The pressure equipment may be subject to inspections prior to putting into service, and to periodic in-service inspections in accordance with the locally applicable rules and regulations.




America

Inspection Body of TÜV Industrie Service  
GmbH TÜV Süd Gruppe  
Notified Body ID No. 0036,  
to Directive 97/23/EC



Industrie Service

Report No.:	P-USA-05-02-14-006 Rev. 1	Page:	3 of 3
<p>TÜV Industrie Service GmbH TÜV Süd Gruppe Notified Body, ID No. 0036, to the Pressure Equipment Directive 97/23/EC</p> <p>For the Inspection Body:</p> <p>Schaumburg, IL March 17, 2005</p> <p> (Thomas Reiners, TÜV Industrie Service GmbH, Industry Service) Notified Body 0036 TÜV SÜD Gruppe</p> <p><b>Annexes:</b></p> <ul style="list-style-type: none"><li>• Copy of the manufacturer's Declaration of Conformity</li></ul>			



Energy & Chemicals  
Chart Industries, Inc.

2191 Ward Avenue  
La Crosse, WI 54601, USA  
Phone: 608.787.3333 Fax: 608.787.2141  
www.chart-ind.com

## EC DECLARATION OF CONFORMITY

Issued in accordance with the

### **PRESSURE EQUIPMENT DIRECTIVE (PED) 97/23/EC**

**Chart Heat Exchangers L.P.**  
2191 Ward Avenue  
La Crosse, WI 54601 USA

We hereby declare that in accordance with the above directive, the product detailed below has been manufactured in accordance with conformity assessment modules B and F "EC Type Examination and Product Verification" as approved by TÜV Industrie Service GmbH TÜV Süd Gruppe (Notified Body No. 0036) of Westendstrasse 199, 80686 München, Germany under EC Certificate of Conformity USA 05/03/14/020, and EC Type Examination Certificate USA 05/03/14/019.

<b>Product Description</b>	Aluminum Plate Fin Heat Exchanger
<b>Product Reference</b>	15772A
<b>Serial Number</b>	509.1-1
<b>Design Code</b>	ASME Section VIII, Division 1, 2001 Edition and 2003 Addenda
<b>Other Applied Standards</b>	EN 288, EN 287, ASME Section IX / PED 97/23/EC
<b>Other Applicable Directives</b>	None

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Kenneth L. Rupp

Position: \_\_\_\_\_

Senior Principal Quality Engineer & Traffic Manager

Date: \_\_\_\_\_

March 18, 2005

Anlage	1	zum Bericht
enclosure		to report
Prüf-nr.	P-USA-05-02-14-006	
Inspect	Rev 1	
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page	fr 2	pages

Reviewed

TÜV SÜD Deutschland Plan und Betrieb GmbH

Notified Body for Pressure

EC Certificate No. 97/23/EC

Issued on

MAR 18 2005



Energy & Chemicals  
Chart Industries, Inc.

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La Crosse, WI 54601, USA  
Phone: 608.787.3333 Fax: 608.787.2141  
www.chart-ind.com

## EC DECLARATION OF CONFORMITY

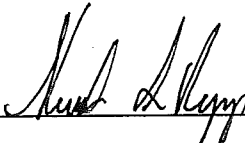
Issued in accordance with the

### **PRESSURE EQUIPMENT DIRECTIVE (PED) 97/23/EC**


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<b>Product Description</b>	Aluminum Plate Fin Heat Exchanger
<b>Product Reference</b>	15772A
<b>Serial Number</b>	509.1-2
<b>Design Code</b>	ASME Section VIII, Division 1, 2001 Edition and 2003 Addenda
<b>Other Applied Standards</b>	EN 288, EN 287, ASME Section IX / PED 97/23/EC
<b>Other Applicable Directives</b>	None

Signed:   
Name: Kenneth L. Rupp  
Position: Senior Principal Quality Engineer & Traffic Manager  
Date: March 18, 2005

Anlage	zum Bericht
enclosure	to report
Prüfung	
(ins. cl.)	P-USA-05-02-14-006
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page 2	pages

Reviewed  
TÜV SÜDdeutschenland Fern und Betrieb GmbH  
Notified Body  
Pressure  
Equipment Directive 97/23/EC  
Testing Laboratory MAR 18 2005 



Industrie Service

# CERTIFICATE ZERTIFIKAT

## EC Type-Examination (Module B) according to Directive 97/23/EC

EG-Baumusterprüfung (Modul B) nach Richtlinie 97/23/EG

**Certificate No.:** USA 05/03/14/019

*Zertifikat-Nr.*

**Name and Address  
of the Manufacturer:**

*Name und Anschrift  
des Herstellers*

CHART Heat Exchangers  
2191 Ward Ave.  
La Crosse, WI 54601, USA

**We herewith certify that the type mentioned below meets the requirements of  
Directive 97/23/EC.**

*Hiermit wird bescheinigt, daß das unten genannte EG-Baumuster die Anforderungen der Richtlinie 97/23/EG erfüllt.*

**Final Assessment Report No.:**

*Abnahmeprüfbericht Nr.*

P-USA-05-02-14-006 Rev. 1

**EC Type Examination Report No.:**

*EG-Baumusterprüfbericht Nr.*

P-USA-05-02-14-004 Rev. 1

**Scope of Approval:**

*Geltungsbereich*

Aluminum Plate Fin Heat Exchanger,  
Drawing No. 15772A

**Location of Manufacture:**

*Fertigungsstätte*

same as above

**The Validity of this Certificate expires**

**March 31, 2015.**

**It may be extended upon request.**

Schaumburg, IL, March 17, 2005

Place, Date

Please see remarks on second page.

TÜV America, Inc.

Industry Service

5 Cherry Hill Drive

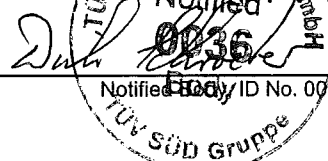
Danvers, MA 01923, USA

Phone: 978-739-7000

Fax: 978-777-7634

E-Mail: info\_ics@tuvam.com

TÜV Industrie Service GmbH  
TÜV SÜD Gruppe  
TÜV CERT-Certification Body  
for Pressure Equipment



Notified Body ID No. 0036

Member of

CONFÉDÉRATION EUROPÉENNE

**CEOC**

D'ORGANISMES DE CONTRÔLE



## **Information regarding the TÜV CERT Certificate**

This certificate is only valid for the referenced company and its facilities stated on the certificate. Only the Certification Body is allowed to transfer (assign) it to a third party.

The right to use the marking depicted on the certificate covers solely products, which match with the type approval and the specifications within the test report or within its complementary (additional) agreements.

Each product has to contain (be accompanied by) the necessary operating and assembly instructions.

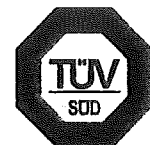
Each product must bear the clearly visible identification of the manufacturer or importer as well as a type plate, in order to identify the compliance of the type approval with the product placed on the market.

The holder of the TÜV CERT certificate is obliged to continuously observe if the manufacture of the marked products complies with the test requirements; he is obliged to perform the control tests defined within the test requirements or by the Certification Body in an orderly manner.

Aside from the conditions referenced above, the conditions within the General Contract are effective for the TÜV CERT certificate. It is valid as long as the state of the art requirements on which the test (approval) was based, are effective, if it was not withdrawn prior on conditions within the General Contract.

If this certificate expires or is withdrawn it has to be returned to the Certification Body immediately.





Industrie Service

# CERTIFICATE OF CONFORMITY ZERTIFIKAT

## Product Verification (Module F) according to Directive 97/23/EC

*Prüfung des Produktes (Modul F) nach Richtlinie 97/23/EG*

**Certificate No.:** USA 05/03/14/020 (replaces USA 05/02/14/004)  
*Zertifikat-Nr.*

**Name and Address  
of the Manufacturer:**  
*Name und Anschrift  
des Herstellers*

CHART Heat Exchangers  
2191 Ward Ave.  
La Crosse, WI 54601, USA

**We herewith certify that the results of the examinations of the pressure equipment described below meet the requirements of Directive 97/23/EC. The pressure equipment complies with the EC Type-Examination and carries the mark as illustrated:**

*Hiermit wird bescheinigt, daß die Ergebnisse der an dem unten genannten Druckgerät vorgenommenen Prüfungen die Anforderungen der Richtlinie 97/23/EG erfüllen. Das Druckgerät entspricht dem Baumuster und ist mit dem abgebildeten Zeichen gekennzeichnet:*

**CE 0036**

**Final Assessment Report No.:**

*Abnahmeprüfbericht Nr.*

P-USA-05-02-14-006 Rev. 1

**EC Type Examination Certificate No.:**

*Zertifikat Nummer der EG Baumusterprüfung*

USA 05/03/14/019

**Scope of Approval:**

*Geltungsbereich*

Aluminum Plate Fin Heat Exchanger,  
Drawing No. 15772A

Serial Nos. 509.1-1, 509.1-2

**Location of Manufacture:**

*Fertigungsstätte*

same as above

Schaumburg, IL, March 17, 2005

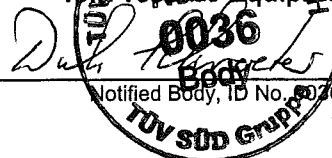
Place, Date

Please see remarks on second page.

TÜV America, Inc.  
Industry Service  
5 Cherry Hill Drive  
Danvers, MA 01923, USA

Phone: 978-739-7000  
Fax: 978-777-7634  
E-Mail: info\_ics@tuvam.com

TÜV Industrie Service GmbH  
TUV Sud Gruppe  
TÜV-CERT-Certification Body  
for Pressure Equipment



Member of  
CONFÉDÉRATION EUROPÉEN



D'ORGANISMES DE CONTRÔLE



Industrie Service

## Information regarding the TÜV CERT Certificate

This certificate is only valid for the referenced company and its facilities stated on the certificate. Only the Certification Body is allowed to transfer (assign) it to a third party.

The right to use the marking depicted on the certificate covers solely products, which match with the type approval and the specifications within the test report or within its complementary (additional) agreements.

Each product has to contain (be accompanied by) the necessary operating and assembly instructions.

Each product must bear the clearly visible identification of the manufacturer or importer as well as a type plate, in order to identify the compliance of the type approval with the product placed on the market.

The holder of the TÜV CERT certificate is obliged to continuously observe if the manufacture of the marked products complies with the test requirements; he is obliged to perform the control tests defined within the test requirements or by the Certification Body in an orderly manner.

Aside from the conditions referenced above, the conditions within the General Contract are effective for the TÜV CERT certificate. It is valid as long as the state of the art requirements on which the test (approval) was based, are effective, if it was not withdrawn prior on conditions within the General Contract.

If this certificate expires or is withdrawn it has to be returned to the Certification Body immediately.

March 17, 2005

Pat Goethel  
CHART Heat Exchangers  
2191 Ward Ave.  
La Crosse, WI 54601, USA

**Report No. P-USA-05-02-14-004 Rev. 1 on EC Type Examination (Module B) of:**  
Plate Fin Heat Exchanger, Sales Order 509.1, Drawing No. 15772A

Dear Mr. Goethel:

In accordance with your application from March 02, 2005 we have examined the submitted documentation according to Module B of the Pressure Equipment Directive 97/23/EC based on the code / standard ASME Section VIII Div. 1, 2001 Edition 2003 Addenda as specified in your submittal. The standards referred to in Article 5 of Directive 97/23/EC were not applied in full.

Result of the Examination:

- No objections were noted.
- The comments made in the pertaining documentation have to be observed.
- A re-submittal of the documentation is not required.
- Materials of construction must comply with the the requirements of the Particular Material Appraisal P-USA-05-02-14-005 Rev. 1
- Deviations from Particular Material Appraisals P-USA-05-02-14-005 Rev. 1 should not occur.
- Suitable, non-standardized test processes and procedures that are used: none
- Suitable test / measurement results, and/or examinations and their results that are used: none

**Other Remarks:**

- The design / equipment for external fire was not part of this examination.
- Evidence of the approval of permanent joining procedures was submitted.
- Evidence of the approval of joining personnel was submitted.
- We have retained one copy each for our files.
- The examination results relate to the documents listed below only.
- A partial duplication of this report / approval without the written consent of the Notified Body is not permitted.

TÜV America Inc.  
1821 Walden SQ Office  
Suite 316  
Schaumburg, IL 60173

Phone: (847) 397-9847  
Fax: (847) 397-9849  
E-mail: [info@tuvam.com](mailto:info@tuvam.com)  
[www.TUVamerica.com](http://www.TUVamerica.com)

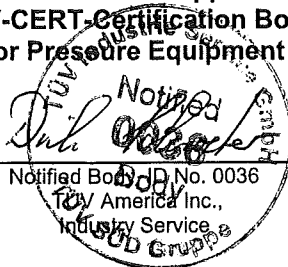


**Appeals Process:**

An appeal against the results of this design examination can be filed verbally or in writing any time with TÜV America Inc., Industry Service, at above address.

Sincerely,

**TÜV Industrie Service GmbH  
TÜV Süd Gruppe  
TÜV-CERT-Certification Body  
for Pressure Equipment**



**Annex:**

Drawing Nos. 15772A Rev. B, 15772B Rev. A, 15772C Rev. E, 15772Z Rev. B and 15772NPCE Rev. 0  
Design Calculations SDP54 ver. 2004.09.30 dated 03 Dec 04 drw 15772A Rev. A  
Bill of Material Drw 15772A  
EC Type Examination Report P-USA-05-02-14-004 Rev. 1  
Particular Material Appraisal P-USA-05-02-14-005 Rev. 1



Industrie Service

P-USA-05-02-14-004 Rev.1

**EC Type Examination Report**  
**Plate Fin Heat Exchanger, Drawing No. 15772A,**  
**Sales Order 509.1**

**Contractor & Manufacturer:** CHART Heat Exchangers  
2191 Ward Ave.  
La Crosse, WI 54601, USA

**Applicable Requirements:** EU Pressure Equipment Directive 97/23/EC (PED)  
PED Annex I

**Drawing No.:** 15772A Rev. B,  
15772B Rev. A,  
15772C Rev. E,  
15772Z Rev. B,  
15772NPCE Rev. 0  
Bill of Material Drw. 15772A

**Design Calculation:** SDP54 ver. 2004.09.30 dated 03 Dec 04  
drw 15772A Rev. A

**Joint Eff.:** 0,70 max.

**Corr. Allowance:** None

**Content:** Fluid Group 2

**Design Temp:** -196°C to 65°C

**Properties:**

Stream	Design Pressure [bar]	Capacity [liter]	Pneu. Test Pressure [bar]	Fluid Group	Category
A	0 / 7.5	2345	11.3	1	IV

**Materials of Construction:** Aluminum Alloys 3003, 5083

**TÜV Project #:** CS500135, CS501133

**Inspector/Engineer:** Dipl.-Ing. Thomas Reiners  
TÜV Industrie Service GmbH TÜV Süd Gruppe /  
TÜVAmerica Inc.  
Notified Body ID# 0036



Industrie Service

P-USA-05-02-14-004 Rev.1

### **1.0 Remarks**

Chart Heat Exchangers has been contracted to design and fabricate a Heat exchanger (Plate Fin Heat Exchanger) to PED requirements for application in a European Community Member State. The organization intends to provide the equipment with CE marking. The manufacturer has identified Modules B + F as Conformity Assessment Modules of choice. The manufacturer has identified the use of ASME Code Section VIII Div. 1 as the technical standard for the design and construction of the equipment, and for compliance with PED Annex I requirements.

Notified Body services for Conformity Assessment Modules B + F (EC Type-Examination and Product Verification) have been requested from and contracted to TÜV Industrie Service GmbH TÜV Süd Gruppe (Notified Body – NB ID# 0036).

### **2.0 Basis for Type Examination**

- Manufacturer's Request to provide NB services for Conformity Assessment Module B
- The manufacturer's written declaration to the effect, that a similar application has not been lodged with another NB.
- Technical Documentation consisting of
  - description and hazard analysis of the heat exchanger
  - design / manufacturing drawings (15772A)
  - Bill of Material Drw. 15772A
  - information on the operation of the equipment,
  - the identification of standard(s) applied to meet the essential requirements of the PED,
  - design calculations and supplement calculations (both dated 03 Dec 2004)
  - Fin Pressure Rating Abstract DWK10/13/00

The compliance of pressure boundary materials (main pressure bearing parts) with PED requirements is achieved by application of a Particular Material Appraisal (PMA). The manufacturer has simultaneously requested this PMA.

### **3.0 Applicable Requirements**

- EU Pressure Equipment Directive 97/23/EC
- ASME Code Sect. VIII Div. 1 – 2001 ED, 2003 AD identified by the manufacturer as the technical design and construction code to meet PED Annex I requirements
- Particular Material Appraisal – P-USA-05-02-14-005 Rev. 1

The Particular Material Appraisal (P-USA-05-02-14-005 Rev. 1) serve as an integral part of this evaluation / examination.

#### 4.0 Design Data

Design Temperature:	-196°C to 65°C
Design Pressure:	Stream A 7.5 bar
Capacity:	Stream A 2345.0 liter
Test Pressure:	Stream A 11.3 bar
Joint Efficiency:	0,70 max.
Corrosion Allowance:	None
Heat exchanger Content:	Fluid Group 1

#### 5.0 Materials of Construction and Material Characteristics

Item	Material Specification	Allow. Stresses / Characteristics	PMA
Header	ASME SB-209-5083- O	11400 psi	P-USA-05-02-14-005 Rev. 1
Nozzle	ASME SB-241-5083 - O	10700 psi	P-USA-05-02-14-005 Rev. 1
Outside Sheet	ASME SB-209-3003 - H112	3400 psi (allow. tensile stress) 2720 psi (allow. shear stress)	P-USA-05-02-14-005 Rev. 1
Core Block Bar	ASME SB-221-3003 - O or H112 (see Dwg.)	3400 psi (allow. tensile stress)	P-USA-05-02-14-005 Rev. 1
Parting Sheet	ASME SB-209-Alclad 3003 - H14	3400 psi	P-USA-05-02-14-005 Rev. 1
Fin Material	ASME SB-209-3003 - O or H12	Fin Rating Method was applied for core block (ASME Code Sect. VIII Div. 1, U-2(g))	P-USA-05-02-14-005 Rev. 1

All above identified materials used in the construction of this equipment, must meet the specifics of the Particular Material Appraisal (see document P-USA-05-02-14-005 Rev. 1).

#### 6.0 Design Calculation Method

The manufacturer applied in principle the calculation method 'design by formula'. The formulas used are ASME Code Sect. VIII Div. 1 formulas – various sections – identified in the manufacturer's calculations. The equipment is calculated for internal and external pressure (as specified on the drawings), taken the specified design temperatures (min. & max.) and static loading conditions into consideration. For core block components, a supplementary Fin Rating Method was used in full compliance with ASME Code Sect. VIII, Div. 1 U-2(g). This, in principle, satisfies PED Annex I, Section 2.2.2 requirements.



The NB performed crosscheck calculations using the formulas provided. The NB confirms experience with this type of Plate Fin Heat Exchanger design. The manufacturer confirmed experience with approx. 10,000 exchangers that collectively contain well over a billion fin legs for the validation of the core design.

### **7.0 Type Examination Conclusion and Obligations**

The calculations and supplied documentation revealed that the heat exchanger is adequately designed for its intended use and for reasonably foreseeable operating conditions. Requirements of the Pressure Equipment Directive 97/23/EC Annex I Section 2 are fulfilled. In all cases, the PED maximum permissible general membrane stress is greater than the ASME Code maximum allowable stress, which was used by the manufacturer in his calculation.

The specified pressure for the pneumatic pressure tests (see section 4.0 of this report) are in conformance with ASME Code Sect. VIII Div. 1. The streams receive pneumatic pressure tests. The provisions of section 7.4 do not apply to pneumatic pressure testing. The pressure test margins comply in general to ASME Code Section VIII Div. 1 and similar pressure vessel code (e.g. AD-2000 Guideline HP30) requirements. The manufacturer (Chart) has taken appropriate measures to satisfy Annex I Sections 3.2.2 and 7.4 in full.

Information pertaining to

- the overall and fully equipped pressure equipment assembly
- wear during operation
- provisions for filling and discharge
- the protection of the heat exchanger against the allowable limits

was not provided by the manufacturer (or was inconclusive) and, therefore, could not be evaluated by the NB against requirements of the PED Annex I Sections 2.7, 2.8, 2.9 and 2.10. These issues must

be assessed in connection with the evaluation of the pressure equipment overall assembly prior to operation [PED Article 3 (2.)].

The heat exchanger must be fitted with suitable protection against the allowable limits. This device(s) may be a safety accessory as defined in PED Article 1 Section 2.1.3 or a monitoring device such as indicators and/or alarms which enable adequate action to be taken either automatically or manually to keep the heat exchanger within the allowable limits, or a combination of the above.

The organization responsible for the overall pressure equipment assembly must apply appropriate protection measures against residual hazards (where applicable) and warn for unintended use and equipment alteration. Installation and/or operating instructions (see PED Annex I Section 3.4) must be drawn up in the official language of the country of destination / equipment operation or in a language mutually agreed upon between the purchaser and supplier.





Industrie Service

P-USA-05-02-14-004 Rev.1

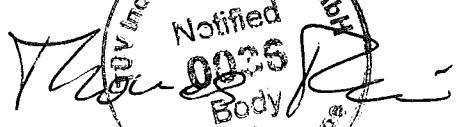
## **8.0 Manufacturing Requirements**

The manufacturer is obligated to fulfill all appropriate requirements of PED Annex I Section 3. This includes the Marking and Labeling of the equipment as identified in PED Annex I Section 3.3. The NB must perform the heat exchanger's final shop inspection & witness the pressure tests identified in PED Annex I Sections 3.2.1 and 3.2.2 respectively. A Certificate of Conformity for PED Module F will be drawn up and provided by the NB upon completion. The manufacturer, or his authorized representative established within the Community, must keep a copy of the declaration of conformity for a period of ten years after the last of the pressure equipment has been manufactured.

## **9.0 Scope of Validity**

This type examination is valid only for the pressure equipment, its application & application parameters, materials & data, and legal and technical requirements identified in this report. This examination may need to be reevaluated and revised by this Notified Body if a change(s) related to above-mentioned issues and data is made.

Schaumburg, IL, March 17, 2005

  
Dipl.-Ing. Thomas Reiners  
TÜV Industrie Service GmbH TÜV Süd Gruppe  
Notified Body ID# 0036

Revision: 1 changed fluid group to 1  
postediting

**ENC.:** Particular Material Appraisals - P-USA-05-02-14-005 Rev. 1  
P-USA-05-02-14-004 Rev. 1.doc



## PARTICULAR MATERIAL APPRAISAL



Industrie Service

CS500135

CS501133

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P-USA-05-02-14-005 Rev. 1

**Particular Material Appraisals**  
**P-USA-02-02-14-001 Rev. 8, P-USA-02-02-14-002 Rev. 7,**  
**P-USA-02-02-14-003 Rev. 9, P-USA-02-02-14-004 Rev. 8,**  
**P-USA-02-02-14-005 Rev. 8, P-USA-02-02-14-006 Rev. 9,**  
**of Fin Heat Exchangers**

**Customer & Manufacturer:** **CHART Heat Exchangers**  
**2191 Ward Ave.**  
**La Crosse, WI 54601, USA**

**Applicable Requirements:** EU Pressure Equipment Directive 97/23/EC (PED), Annex I  
ASME Section VIII Div. 1, 2001 Edition, 2003 Addenda

**Weld Joint Efficiency:** 0.70 max.  
**Corrosion Allowance:** None  
**Design Temp:** -196°C to 65°C  
**Materials of Construction:**  
1. ASME SB-209 – 5083 Temper "O"  
2. ASME SB-241 – 5083 Temper "O"  
3. ASME SB-209 – 3003 Temper "H112" or "H14"  
4. ASME SB-221 – 3003 Temper "O" or "H112"  
5. ASME SB-209 – Alclad 3003 Temper "H14"  
6. ASME SB-209 – 3003 Temper "O" or "H12"

**Drawing Nos.:** **Model 15772A**  
15772A Rev. B  
15772B Rev. A  
15772C Rev. E  
15772Z Rev. B

**Design Calculations:** SDP54 ver. 2004.09.30 dated 03 Dec 04  
drw 15772A Rev. A

**Chamber Design Pressures** 7.5 bar  
2345 liter

**and Volumes:**  
**PED Category:** IV  
**PED Module (or combination)** B+F

**Content** Fluid Group 1

**Inspector / Engineer:** Dipl.-Ing. Thomas Reiners  
TÜV Industrie Service GmbH / TÜV America Inc.



## PARTICULAR MATERIAL APPRAISAL

P-USA-05-02-14-005 Rev. 1



Industrie Service

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### 1 Remarks

CHART Heat Exchangers has specified the use of ASME Code Section II materials in the manufacture of pressure equipment for installation in a European Community Member State. The company intends to provide the equipment with CE marking (except for equipment under Article 3 Section 3 "sound engineering practice"). Module B+F have been identified as Conformity Assessment Modules of choice by the manufacturer. In the supplied Technical Documentation the manufacturer has specified the materials of choice and the essential characteristics of such materials. Unless materials are used that comply with applicable Harmonized Standards or European Approval of Materials, the compliance of materials with the requirements of the Directive is achieved by application of a Particular Material Appraisal (PMA), performed by the Notified Body (NB).

All base materials must meet PED Annex I Section 4 and applicable Section 7 requirements.

The company has identified the Heat Exchanger model for compliance with the PED and this Particular Material Appraisal. These types are multi-chamber vessels. The NB will review the additions / changes for impact on these PMAs. If necessary, the PMAs will be revised.

The tests and inspections identified in Section 2 of this plan are necessary in order to provide sufficient information on the suitability of these materials in meeting PED Annex I requirements.

### 2 Base Materials

- For main pressure bearing parts acc. to Section 2.1: If the material manufacturer fulfills the requirements of Annex I Section 4.3 last paragraph (an) EN 10204-3.1.B-Certificate(s) issued by the material manufacturer is/are sufficient to document material test results. Where the material manufacturer does not comply with Annex I Section 4.3 last paragraph material test results have to be documented in (an) EN 10204-3.1.C-Certificate(s). For pressure parts acc. to Section 2.2 a test report acc. to EN 10204 2.2 is required.
- Please note, that the below tests may not reflect all mandatory tests specified in the respective product code (here: ASME). Therefore all mandatory tests as specified in the product code have to be performed and properly documented.
- Full traceability of the material to the mill test report / material certificate is required. Additionally, full traceability of samples, test specimens and test data identified below is required.
- Identification transfer to test coupon(s) and sample(s) for physical testing prior to separation from the material is required. The transfer of material identification must be performed according to written and approved procedures.
- The manufacturer must retain the certificate(s) in the Technical Documentation for a period of ten (10) years after the last of the pressure equipment has been manufactured.



## PARTICULAR MATERIAL APPRAISAL



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### 2.1 Materials used for main pressure bearing parts

- |    |   |                                   |
|----|---|-----------------------------------|
| 1. | ASME SB-209 – 5083 Temper "O"           | see PMA P-USA-02-02-14-001 Rev. 8 |
| 2. | ASME SB-241 – 5083 Temper "O"           | see PMA P-USA-02-02-14-002 Rev. 7 |
| 3. | ASME SB-209 – 3003 Temper "H112"        | see PMA P-USA-02-02-14-003 Rev. 9 |
| 4. | ASME SB-221 – 3003 Temper "O" or "H112" | see PMA P-USA-02-02-14-004 Rev. 8 |
| 5. | ASME SB-209 – Alclad 3003 Temper "H14"  | see PMA P-USA-02-02-14-005 Rev. 8 |
| 6. | ASME SB-209 – 3003 Temper "O" or "H12"  | see PMA P-USA-02-02-14-006 Rev. 9 |

### 2.2 Materials used for non-main pressure bearing parts (nozzles, fittings smaller 2" dia.)

### 2.3 Attachments to pressure bearing parts

### 3 Conclusion and Validity

Adherence to the above outlined material tests, test frequencies, requirements and conditions satisfy the Pressure Equipment Directive 97/23/EC Annex I Section 4 and applicable Section 7 requirements.

This appraisal is valid only for the pressure equipment, its application and application parameters, materials and data, and legal and technical requirements identified in this document. This appraisal may need to be reevaluated and revised by this Notified Body if a change related to above mentioned issues and data is made.

Schaumburg, IL, March 17, 2005

Notified  
0036  
Body

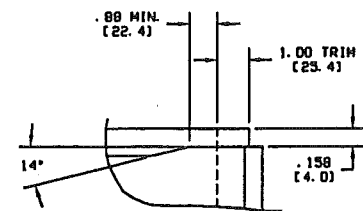
Dipl.-Ing. Thomas Reiners  
TÜV Industrie Service GmbH TÜV Süd Gruppe  
Notified Body ID# 0036

Revision: 1 changed fluid group to 1  
postediting

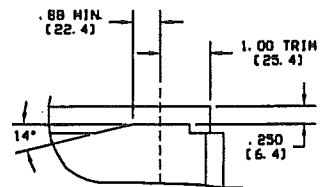
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PMA P-USA-02-02-14-005 Rev. 8  
PMA P-USA-02-02-14-006 Rev. 9

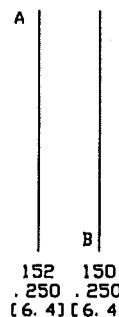
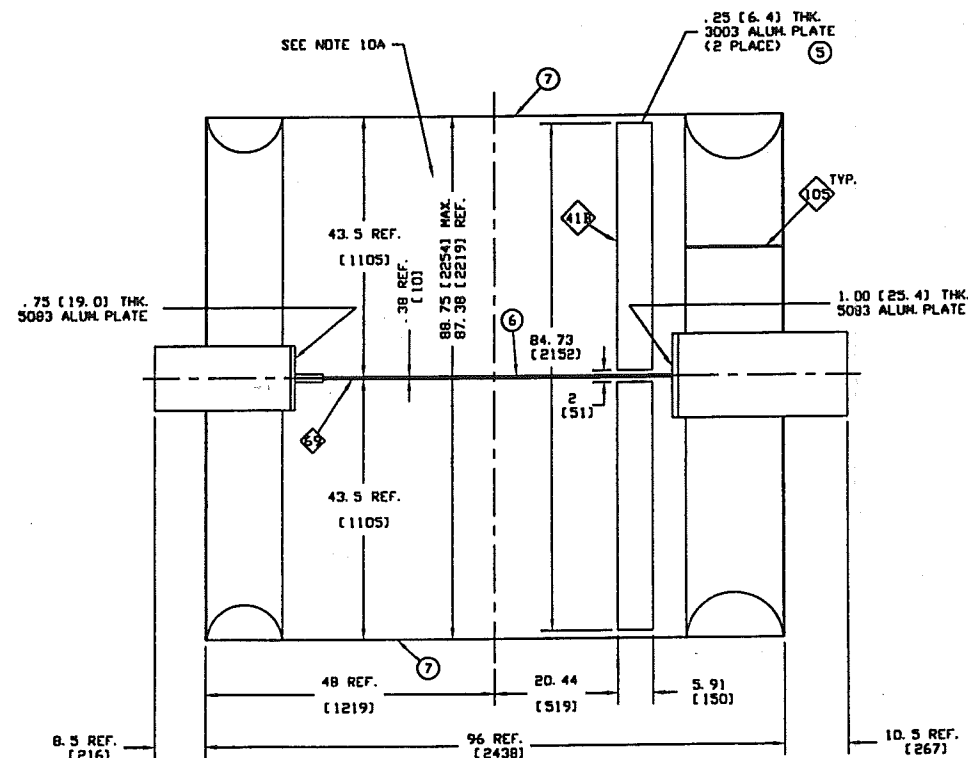
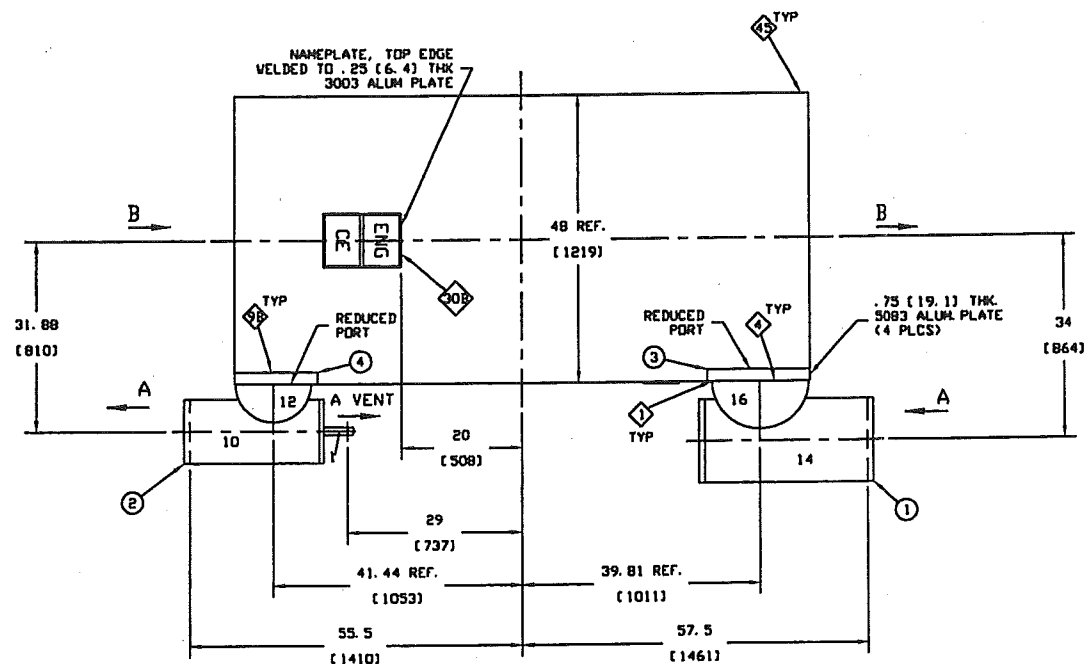
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NOZZLE END PREPARATION - A OUT



NOZZLE END PREPARATION - A IN



FLOW DIAGRAM

Reviewed  
TUV Süddeutschland Bau und Betrieb GmbH  
Notified acc. to Pressure  
Equipment Directive 97/23/EC  
-Testing Laboratory- MAR 17 2005

OPERATIONAL  
TOP END

NOTES:

- HEAT EXCHANGER DESIGNED, CONSTRUCTED, AND STAMPED PER THE LATEST MANDATORY EDITION AND ADDENDA OF THE ASME PRESSURE VESSEL CODE, SECTION VIII, DIV. 1 AND REGISTERED WITH THE NATIONAL BOARD.
- THE HEADERS AND NOZZLES ARE LABELED ON THE DRAWING WITH THEIR NOMINAL PIPE SIZE (NPS). IF A STANDARD SIZE IS NOT USED THE PIPING IS LISTED AT ITS ACTUAL OUTSIDE DIAMETER AND LABELED "OD". UNLESS SHOWN OTHERWISE ALL NOZZLES ARE ON THE HEAT EXCHANGER CENTERLINE.
- TOLERANCE ON ALL DIMENSIONS IS  $\pm .25$  INCH (6) UNLESS OTHERWISE NOTED. TOLERANCE ON NOZZLES IS CONTROLLED BY THE TOLERANCE ON THE CARTESIAN COORDINATE DIMENSIONS (X, Y, Z). IN NO CASE SHALL THE ANGULAR TOLERANCE EXCEED 3 DEGREES.
- STREAM:  
HWP (PSIG) 109 SEE NOTE  
(BARG) (7.5) 109  
DESIGN TEMP DEG. F + 150 MAX. 320 MIN.  
(C) (+65) MAX. (-196) MIN.

5. TESTING INFORMATION:

STREAM	A	B
FIRST AIR (PSIG) (BARG)	36 (2.5)	---
HWP (PSIG) (BARG)	164 (11.3)	---
LEAK (PSIG) (BARG)	109 (7.5)	---

6. A. I. WITNESS REQUIRED.

HELIUM VACUUM LEAK TEST	MAX. ALLOW. LEAKAGE
STREAMS	
A - EXT	1. E-3 STD CC/SEC (1. E-3 MBAR L/SEC)
6. UNIT TO BE CLEANED FOR OXYGEN SERVICE. (INTERNAL AND EXTERNAL)	
7. CONNECTIONS TO BE SUITABLY MARKED FOR FIELD TRIM.	
8. ESTIMATED WEIGHT = 16,200 LBS. (DRY) (7,347) KG 21,400 LBS. (FILLED WITH WATER) (9,705) KG (WARNING: DO NOT HYDRO TEST IN FIELD WITH WATER)	

9. STREAM VOLUME:

STREAM	A	B
CU. FT. (CU. M.)	82.8 (2.34)	75.3 (2.13)

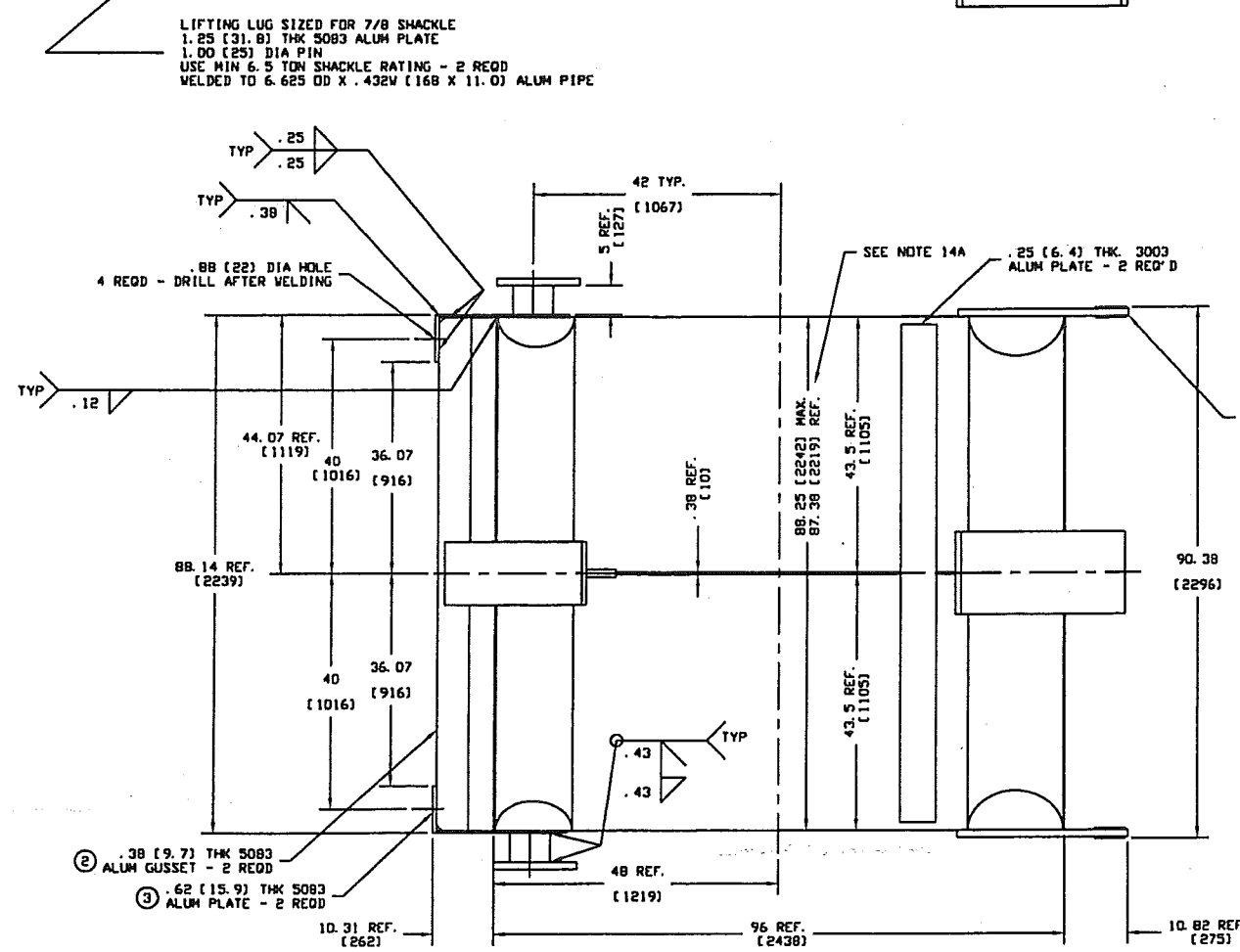
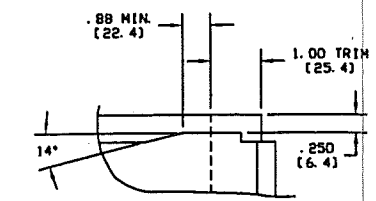
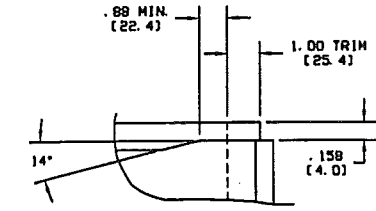
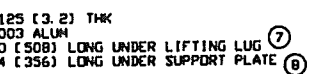
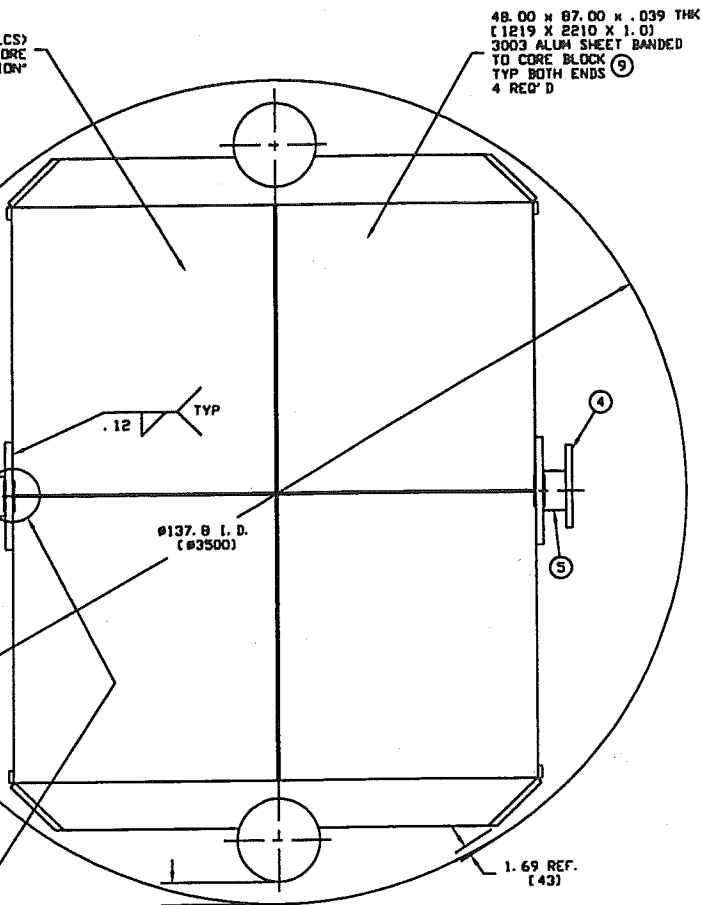
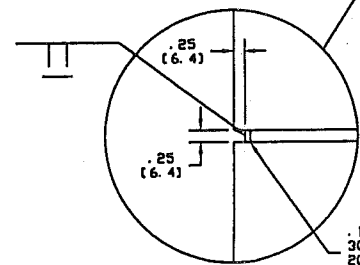
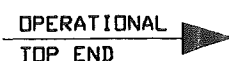
10. CUSTOMER NOTE:

- ESTIMATED BRAZE HEIGHT. ACTUAL BRAZE HEIGHT MAY VARY  $\pm .12$  INCH/FOOT ( $\pm .10$  MM/M) OF BRAZE HEIGHT. MAX DIMENSION INCLUDES TOLERANCE ON BRAZE HEIGHT.
  - DURING OPERATION THE "B" STREAM SUBJECTS THE EXCHANGER TO EXTERNAL PRESSURE. EXCHANGER DESIGNED FOR 44 PSIG (3.0 BARG) EXTERNAL PRESSURE (EXTERNAL HWP = 47 PSIG (3.2 BARG)) BUT NOT TESTED BY CHART. IF THE "B" STREAM IS PRESSURE TESTED AFTER INSTALLATION DO NOT SUBJECT THE EXCHANGER TO A DIFFERENTIAL PRESSURE (GAUGE + LID HEAD, "B" STREAM TO "A" STREAM) GREATER THAN 1.3 TIMES THE EXTERNAL HWP.
  - EXTERNAL HWP OF EACH PIPING RUN TO BE DETERMINED BY CUSTOMER. DEPENDING ON PIPING CONFIGURATION, EXTERNAL HWP MAY BE LOWER THAN EXTERNAL HWP OF THE EXCHANGER.
  - CLEANING SPECIFIED IN NOTE 6 COMPLIES WITH AL 50274.01-D AND W-6S-3-1-1.
11. PED NOTE:
- HEAT EXCHANGER TO COMPLY WITH EU PED 97/23/EC, ASSESSMENT MODULE "B & F".
  - PED NOTIFIED BODY IS TUV SÜDDEUTSCHLAND BAU UND BETRIEB.
  - ASSESSMENT CATEGORY IS "IV", WORKING FLUIDS ARE GROUP 1 (A STREAM).
12. PRODUCTION NOTES:
- INSPECT OPEN PASSAGES FOR BLOCKAGE USING LIGHT TEST.
  - AFTER BRAZING MEASURE AND RECORD FIN GAPS ON OPEN PASSES.
  - AFTER BRAZING MEASURE AND RECORD HEIGHT OF PORT FIN ON OUTER OPEN PASSES.

STREAM	INLET		OUTLET	
	HEADER O. D. X WALL	NOZZLE O. D. X WALL	HEADER O. D. X WALL	NOZZLE O. D. X WALL
A	16.000 X .375 (406 X 9.5)	14.000 X .375 (356 X 9.5)	12.750 X .375 (324 X 9.5)	10.750 X .365 (273 X 9.3)
A-VENT				1.315 X .133 (33 X 3.4)
B				

ALL MATERIAL IN TABLE ABOVE IS 5083 ALUMINUM

REVISION RECORD	A		B		DR DATE	DOVAL DATE	STD ENGR SPEC	CHART HEAT EXCHANGERS, LP. ALL RIGHTS RESERVED	Chart Heat Exchangers
	ADDED PRODUCTION SYMBOLS REMOVED	TESTING HEADERS ENDS WERE ENTERED	FLUTING WERE GROUP 2	3-2-05 LASSON					
DATE	10-26-04	10-28-04	11-5-04		DATE	10-26-04	11-5-04	THIS DRAWING AND INFORMATION ARE THE CONFIDENTIAL PROPERTY OF CHART HEAT EXCHANGERS, LP. WITHOUT WRITTEN CONSENT IT MAY NOT BE COPIED, USED OR COMMUNICATED TO OTHERS WHOLLY OR IN PART.	© CHART HEAT EXCHANGERS, LP. ALL RIGHTS RESERVED
DATE	10-26-04	10-28-04	11-5-04		DATE	10-26-04	11-5-04	LEGEND	
DATE	10-26-04	10-28-04	11-5-04		DATE	10-26-04	11-5-04	○ PART NUMBER (PRODUCTION USE ONLY)	
DATE	10-26-04	10-28-04	11-5-04		DATE	10-26-04	11-5-04	◇ JOINT DETAIL-REF. (PRODUCTION USE ONLY)	
DATE	10-26-04	10-28-04	11-5-04		DATE	10-26-04	11-5-04	□ FIN DATA INFORMATION	
DATE	10-26-04	10-28-04	11-5-04		DATE	10-26-04	11-5-04	△ DIMENSIONAL REVISION	
DATE	10-26-04	10-28-04	11-5-04		DATE	10-26-04	11-5-04	□ SPECIAL NOTATION	
DATE	10-26-04	10-28-04	11-5-04		DATE	10-26-04	11-5-04	DIMENSIONS: PRIMARY IN INCHES, SECONDARY IF SHOWN IN (MM)	
DATE	10-26-04	10-28-04	11-5-04		DATE	10-26-04	11-5-04	THIS IS A FULL PROJECTION	
DATE	10-26-04	10-28-04	11-5-04		DATE	10-26-04	11-5-04	SIZE (INCHES)	15772A
DATE	10-26-04	10-28-04	11-5-04		DATE	10-26-04	11-5-04	ITEM NO.	V21001
DATE	10-26-04	10-28-04	11-5-04		DATE	10-26-04	11-5-04	REV.	B



Reviewed  
TÜV Süddeutschland Bau und Betrieb GmbH  
Notified Body for Pressure  
Equipment Directive 97/23/EC  
-Testing Laboratory-  
MAR 17 2005

NOTES:

1. REFER TO BRAL-107C FOR INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS. ASSURE COMPLIANCE WITH REQUIREMENTS PARTICULARLY OPERATING CONDITIONS TO PREVENT OVER PRESSURIZATION, THERMAL SHOCK AND OPERATION OUTSIDE DESIGN TEMPERATURE RANGE. REFER TO DRAWING 15597L FOR UNCRATED HEAT EXCHANGER LIFTING INSTRUCTIONS. HEAT EXCHANGER SHIPS ON SURFACE SPECIFIED BY CUSTOMER TO AVOID NEED FOR ROLLING. IF HEAT EXCHANGER MUST BE ROLLED FOR INSTALLATION CONSULT CHART FOR INSTRUCTIONS.
2. HEAT EXCHANGER DESIGNED, CONSTRUCTED, AND STAMPED PER THE LATEST MANDATORY EDITION AND ADDENDA OF THE ASME PRESSURE VESSEL CODE; SECTION VIII, DIV. 1 AND REGISTERED WITH THE NATIONAL BOARD.
3. SEE DRAWING 1577EC FOR MAXIMUM ALLOWABLE PIPE LOADS.
4. THE HEADERS AND NOZZLES ARE LABELED ON THE DRAVING WITH THEIR NOMINAL PIPE SIZE (NPS). IF A STANDARD SIZE IS NOT USED THE PIPING IS LISTED AT ITS ACTUAL OUTSIDE DIAMETER AND LABEL "OD". UNLESS SHOWN OTHERWISE ALL NOZZLES ARE ON THE HEAT EXCHANGER CENTERLINE.
5. TOLERANCE ON ALL DIMENSIONS IS +/- .25 INCH (.6) UNLESS OTHERWISE NOTED. ANGULAR TOLERANCE ON NOZZLES IS CONTROLLED BY THE TOLERANCE ON THE CARTESIAN COORDINATE DIMENSIONS (X,Y,Z). IN NO CASE SHALL THE ANGULAR TOLERANCE EXCEED 3 DEGREES.
6. STREAM                                 A                                 B  
HWP (PSIG)                         109                         SEE NOTE  
    (BARG)                         (7.5)                         14B  
DESIGN TEMP DEG. F + 150 MAX.     -320 MIN.  
                (C)(+65) MAX. (-196)MIN.

IMPNEU	(PSIG)	164	---
	(BARG)	(11.3)	---
LEAK	(PSIG)	109	---
	(BARG)	(7.5)	---

-----  
 IS A 1. WITNESS REQUIRED.

8. UNIT TO BE CLEANED FOR OXYGEN SERVICE. (INTERNAL AND EXTERNAL)
9. CONNECTIONS TO BE SUITABLY MARKED FOR FIELD TRIM
10. UNIT TO SHIP WITH H<sub>2</sub> AT 5 PSIG (.3 BARG) IN "A" STREAM GAUGES ARE REQUIRED.
11. ESTIMATED WEIGHT = 32,700 LBS. (DRY)  
[14,829] KG
12. STREAM VOLUME:

	A	B
CU. FT.	166.0	151.0
[CU. M.]	[4.70]	[4.27]

13. CUSTOMER REQUIREMENT:
- A. ONE MITERED END TO BE SPOT RADIOGRAPH INSPECTED PER ASME PRESSURE VESSEL CODE, SECTION VIII, DIVISION 1, PAR U-52.
  - B. ALL WELDS TO BE DYE PENETRANT EXAMINE PER ASME CODE, SECTION VIII, DIVISION 1.

14. CUSTOMER NOTE:
- A. ESTIMATED BRAZE HEIGHT. ACTUAL BRAZE HEIGHT MAY VARY +/- .12 INCH/FOOT (+/- 10 MM/M) OF BRAZE HEIGHT. MAX DIMENSION INCLUDES TOLERANCE ON BRAZE HEIGHT.
  - B. DURING OPERATION THE "B" STREAM SUBJECTS THE EXCHANGER TO EXTERNAL PRESSURE. EXCHANGER DESIGNED FOR 44 PSIG (3.0 BARG) EXTERNAL PRESSURE. EXTERNAL MAWP = 47 PSIG (3.2 BARG) BUT NOT TESTED BY CHART. IF THE "B" STREAM IS PRESSURE TESTED AFTER INSTALLATION DO NOT SUBJECT THE EXCHANGER TO A DIFFERENTIAL PRESSURE (GAUGE + LID HEAD, "B" STREAM TO "A" STREAM) GREATER THAN 1.3 TIMES THE EXTERNAL MAWP.
  - C. EXTERNAL MAWP OF EACH PIPING RUN TO BE DETERMINED BY CUSTOMER. DEPENDING ON PIPING CONFIGURATION, EXTERNAL MAWP MAY BE LOWER THAN EXTERNAL MAWP OF THE EXCHANGER.
  - D. CLEANING SPECIFIED IN NOTE 8 COMPLIES WITH AL SC274.01-D AND V-GS-3-1-1.

15. PED NOTE:
- A. HEAT EXCHANGER TO COMPLY WITH EU PED 97/23/EC; ASSESSMENT MODULE "A"
  - B. PED NOTIFIED BODY IS TUV SUEDEUTSCHLAND BAU UND BETRIEB.
  - C. ASSESSMENT CATEGORY IS "IV", WORKING FLUIDS ARE GROUP "1" (A STEAM)

16. PRODUCTION NOTES:  
A. UNIT TO BE WRAPPED IN PLASTIC WITH DESICCANT.

STREAM	INLET		OUTLET	
	HEADER O. D. X WALL	NOZZLE O. D. X WALL	HEADER O. D. X WALL	NOZZLE O. D. X WALL
A (GAN/LIN)	16.000 X .375 (406 X 9.5)	14.000 X .375 (356 X 9.5)	12.750 X .375 (324 X 9.5)	10.750 X .365 (273 X 9.3)
A-VENT (GAN/LIN)	—	—	—	1.315 X .133 (33 X 3.4)
B (BATH)	—	—	—	—

ALL MATERIAL IN TABLE ABOVE IS 5083 ALUMINUM

[illegible]