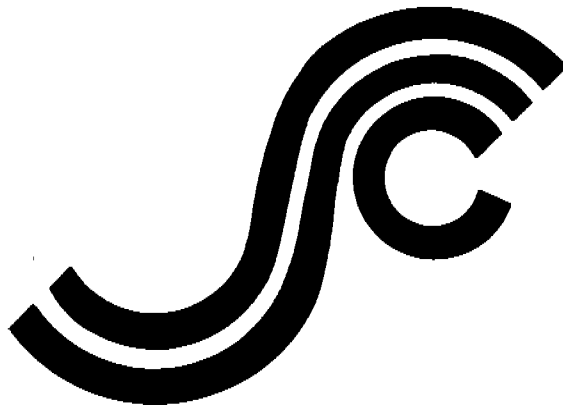


SSC-352

**MARINE STRUCTURAL STEEL
TOUGHNESS DATA BANK
(Abridged Edition)**



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1991

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August 28, 1991

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**MARINE STRUCTURAL STEEL TOUGHNESS DATA BANK
(ABRIDGED EDITION)**

A substantial amount of toughness data for commonly used marine steels is available to ship designers. The information, however, did not exist in a comprehensive database that users could access. The Ship Structure Committee recognized the need for a convenient source of materials design data and sponsored the development of the Marine Structural Steel Toughness Data Bank.

The data bank contains approximately 1,000 records representing 10,000 tests of eleven marine steels. The complete report has nearly 2,000 pages of documentation. In this abridged edition, we are providing data extracts from all principal sections of the report. The complete report was published in four volumes and is available from the National Technical Information Service. A computer based version of the data bank may be accessed through the developers. We trust that this information will prove to be quite useful.

**A. E. HENN
Rear Admiral, U.S. Coast Guard
Chairman, Ship Structure Committee**

Isk

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16. Abstract <p>The Ship Structures Committee has sponsored the development of a data bank covering the toughness of steels for marine applications. Effort focused on the identification and procurement of sources of data containing quantitative toughness data, and the development from those data of a well-documented computerized data bank available to a wide range of engineers and material scientists. Included were raw data from material suppliers and data from papers and technical reports published by a variety of organizations.</p> <p>The principal focus was on Tensile, Charpy V notched bar impact values, fracture toughness (J1c), NDTT, and DT energies; other toughness parameters were included if available for the same lots of material. The materials include steels identified by the Project Technical Committee representing the sponsoring agencies.</p> <p>About 1000 records representing approximately 10,000 tests of eleven steels are included in this prototype version of the data bank. Standard procedures now exist for efficient addition of data for other alloys and properties.</p>					
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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (exact)				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

¹/₁₆ in. = 2.54 (exact) mm. For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price \$2.25, SD Catalog No. C 1.1.10-286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares (10,000 m ²)	2.5	acres	
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m ³	cubic meters	35	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³
TEMPERATURE (exact)				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

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ABS-B	1000
ABS-EH32	2000
ABS-EH36	2100
A36	3100
CG A537M	7100
A537 CL1	7300
A572 Gr50	7600
A588	8000
A710	9400
BS4360 Gr50D	13800
HY80	16500
HY100	19500

A Marine Structural Toughness Data Bank

Ship Structures Committee

Final Report

1 Introduction

Despite the substantial number of data available on the toughness of a wide variety of steels which may be used for marine applications, including several important studies by the *Ship Structures Research Committee*, there has been no comprehensive source to which one might go to readily find well-documented numeric data for the full range of materials and types of data of interest. The *Ship Structures Committee* and the *U.S. Coast Guard* recently took the steps needed to begin the establishment of such a source, with first priority given to toughness data for high strength, low alloy steels.

This handbook provides the initial compilation for the Marine Structural Toughness Data Bank, a summary of data from about 10,000 tensile and toughness tests of hundreds of samples representing eleven steels of importance for marine applications.

The result of this program is not only a source of reliable and well-documented numeric data on the toughness of steels, but also the nucleus of a system which may be expanded to include other properties of these steels and other materials which might be considered for such applications. The source will be of value to all segments of the Marine Industry, commercial and military, and to a number of other industry groups which utilize these steels, as well as to the Steel Industry itself.

Also of significant consequence, the program has been carried out in a manner and with procedures and standards compatible with those in use in the development of machine-readable databases by groups such as the *National Materials Property Data Network, Inc. (the MPD Network)*, a network of worldwide sources of data (Refs. 1,2). This assures the opportunity for easy and direct interface and interchange of data with many other sources of numeric materials data.

As an added advantage, new searchers who might be looking for the type of data contained herein but are unaware of the Marine Structural Toughness Data Bank will be directed to it via the online version being established under the name MARTUF on the *MPD Network*. Such users also have access to many other sources of materials data. For additional information on this mode of access to the Marine Structural Toughness Data Bank, please refer to Annex I to this document.

2 Scope

The scope of this program was the development of a data bank on the toughness of steels which may be considered for marine applications such as ship hulls and drilling structures. Eleven steels of importance to the member organizations of the *Ship Structures Committee* are included. Data from a variety of types of toughness tests were included in the database, including Charpy impact, fracture toughness, nil-ductility transition, and drop-weight tear tests. The emphasis of this project was on the collection of data, not its detailed analysis, though efforts were made to assure that problems with identity of individual lots or incomplete reporting of test data were dealt with.

The Marine Toughness Data Bank was developed both in hard copy, as summarized in this document, and in machine readable form. It is available in a searchable online version on the *MPD Network* (where it is referred to as MARTUF; see Annex II and Ref 1,2). It is also available on PC disks in the original Lotus 123 format in which it was assembled from the *Ship Structures Committee*. It is not searchable in this format.

3 Materials Included in Marine Toughness Data Bank

The scope of materials considered for inclusion in this data bank was established by the Technical Committee representing the *Ship Structures Committee*. The original list of materials with the priorities provided is shown in Table 1. The individual priorities for the materials within group 1 are those specifically provided by the Technical Committee; priority numbers within groups 2 and 3 were assigned arbitrarily for convenient reference.

Also shown in Table 1 are alternative designations by which these materials are often identified. Their detailed material property and chemical composition requirements are presented in Table 2, with the order in which the material are presented revised to group like alloys (based upon composition and properties) together. Together these two tables illustrate several important features which had a significant bearing upon the program, viz.:

1. The specifications and properties for these materials overlap to a great extent,
2. It is difficult to be certain which materials are completely equivalent and which are significantly different, and
3. A great amount of information is required in building a database for such materials to provide users with the background necessary to assure than useful and valid comparisons are being made.

This problem has been recognized previously, especially in regard to comparisons with steels covered by foreign specifications. Early and Himes (Refs 3, 4, 5) confronted the problem and determined that in comparing specifications and individual steels themselves it is necessary to consider the composition limits, material property limits, fabrication practices and resultant microstructures, specific quality assurance requirements before drawing conclusions on this matter. They further concluded that several U.S. and foreign steels widely considered to be equivalent were indeed not so when all of these factors were considered.

It was not possible within the constraints of this program to determine without question the relative equivalence of all of the lots of materials for which data were obtained and included in this reference source. Therefore in all cases the identities given individual lots of material in this data bank are those provided by the original investigators plus those from the Unified Numbering System Guide (Ref. 6).

However it is clear from Table 2 that there are several groups of similar materials included in the Marine Toughness Data Bank, notably:

- High strength, low alloy steels A514, HY80 and HY100 containing primarily Ni, Cr, Mn and Mo;
- High strength, low alloy steel A710 and HSLA 80 containing primarily Cu, Ni, Cr and Mo;
- Medium to high strength low alloy steels A537, CG-537, A656, A737, ABS-EH36, and API 5L containing primarily Mn; and
- Medium strength low alloy steels A36, A572, A588, A633, A678, BS4360 and ABS-B and E, also containing primarily Mn.

Within each of the groups the primary alloying elements largely overlap, and their distinctiveness arises from differences in minor alloying elements and mechanical property requirements.

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In the course of this work it was determined that it is appropriate to include certain "equivalent" alloys in the high priority list (making due allowance for tensile strengths, overlapping compositions, etc.). This was based in part on commercial practices.

Priority Alloy	Equivalent
HY80	A543 GrC CL1
A710 GrA	A736
ABS EH36	A737 Gr B
A514E	A517E
HY100	A543 GrC CL2
API5LX60	A572

Given the conditions above and the sources and types of data included within the scope of the search, data were placed into the data bank for the following materials:

ABS-B	A36	A710/A710-A	BS4360 Gr 50D
ABS-EH32	A572 Gr 50	HY80	CG A537M (A537 Cl 1)
ABS-EH36	A588 Gr A	HY100	

These represent 10 of the top 15 priority alloys requested by the Technical Committee, and one (A572) within the second priority set.

Alloying Identification Scheme: It was found convenient when logging the data for inclusion in the data bank to use a three-part identification scheme, in which the first three digits identify the alloy (with a direct relationship to the priority listing provided by the technical Committee); the second set of three digits identifying the specific heat; and the final two digits identifying whether the test sample was parent (base) metal, weld metal or heat-affected zone (HAZ), plus in the latter case the approximate distance of the tested HAZ area from the weld fusion line, *i.e.*, where the base of the notch or precracked tip is positioned 1, 3, 5, etc. mm from the edge of weld deposit. Thus,

XXX.YYY.ZZ

where

- XXX. -Alloy Identifier, from priority code (Table 1)
- YYY. -Heat Number, sequential number
- ZZ -Sample Descriptor, as follows:
 - .01 - Base Metal
 - .02 - On fusion line
 - .03 - 1 mm into HAZ
 - .04 - 3 mm into HAZ
 - .05 - 5 mm into HAZ
 - .06 - 7 mm into HAZ
 - .07 - 9 mm into HAZ
 - .08 - 11 mm into HAZ
 - .09 - All weld metal

In recording this data for retention on the computer, every effort was made to preserve as much detail as possible about the preparation of the specimens tested. It is hoped that this will permit studies to be made of the effects of compositional materials or process variables on performance. This is required recording ingot position, welding parameters, specimen location, information about prior staining and postwelding heat treatment.

In order to maintain the individuality of material information records which differed only slightly, letters or numbers were added to the Material Codes. For example, when the top and bottom of the ingot were studied T or B was added. If severail strain-aging conditions were examined, S1, S2, etc. were noted. Multiple welds were recorded as A, B, C, D, etc.

One should be alert to those variables which may distinguish among the property records. For example, one may wish to search for deposit properties, in which case only ".09" records are of interest, or seek information about the fusion line, in which case records including ".02" (and possibly .03) will be of interest. The database offers the potential for studying differences in performance of the root pass or the last pass, or at the mid thickness, distinguishing between when it is or is not the weld root. Thus one must be careful not to mix weld data indiscriminately.

It goes without saying that distinctions between LT and TL specimens of the base metal need to be preserved. This was required as well for the weld deposit. It should be noted that L for the deposit was defined as the direction of travel. Since specimens were usually oriented perpendicular to the weld, a toughness measurement was usually described as TL in the deposit. At the fusion line and in the heat affected zone, the base metal specimens would all be transverse to the weld, but the TL orientation designated for the deposit would be switched to LT in the HAZ if the rolling direction were perpendicular to the welding direction.

It must be recognized that all position indicators and other descriptors of location relative to the fusin line or root or surface of the specimen are approximate. Nevertheless, considering all the variables provided for in the database may offer an explanation for some of the scatter in weldment performance observed. The reader should be acquainted with the data recording format if an in-depth study of materials or processing variables is intended.

4 Types of Data (Properties) Covered in the Program

The types of data sought for the data bank included the following:

- Material characterization (including actual composition, fabrication information and weld procedures, where appropriate)
- Tensile properties
- Fracture toughness, from K_{Ic} and J_{Ic} tests
- Charpy V notched bar impact values
- Nil ductility transition temperature
- Dynamic tear energy

Other types of toughness data were also sought, providing test results for at least one of the types above were also presented, and provision for a wide variety of types was made in the schema for the basic structure of the database (Table 4, described in Section V) These additional types of data included:

- Precracked Charpy impact
- Precracked Charpy slow bend
- MRL crack arrest

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- ESSO crack arrest
- Double TT crack arrest
- Wide plate tensile test
- Drop weight tear energy

Several other types of test data were also considered, including the Tearing Modulus, T, but the lack of standard test methods for such parameters led to their being dropped from further study. Interest was expressed in the inclusion of modulus of elasticity values at one point, but it was excluded because the types of tensile tests for which data were being input did not provide reliable measures of modulus in accordance with ASTM standards (ASTM Standard Method E 111).

In fact, during the collections of data, the vast majority of test results located and included within the data bank were from Charpy V notched bar impact tests; 643 of the 1017 records compiled contained Charpy data) Only relatively few fracture mechanics data (12 records, all JIc, and all representing HY80 and HY100) were found. The lack of fracture mechanics parameters found is undoubtedly related to the relatively tough nature of this general class of materials under conditions above their ductile-to- brittle transition temperature.

Table 3 is an "occurrence table" for the data bank, a matrix illustrating the various types of test records for the individual materials. The specific data associated with the various type of tests which were included in the database, and the meaning of the abbreviations are explained in Table 4, the data bank format (see Section V).

5 Format Development

The development of the overall format for the Marine Toughness Data Bank was an evolutionary process. A working format was established at the beginning of the program, covering the whole span of material characterization and test results sought, and the collection of data begun. Dr. Martin Prager, Executive Director of the *Materials Properties Council (MPC)*, was responsible for locating, compiling and evaluating the data. Over the following six-to-twelve months, various examples arose in which more detailed description of the materials or of welding processes or of certain types of test results were required. The result was several iterations in format development, some changes involving only refinements, but others very substantive improvements in documentation of the materials or test data.

The final format established for the data bank is illustrated in Table 4; it is basically a very broad, very long spread sheet, with the material description/test data relationship being basically hierarchical in nature, and with the various segments held together in a relational fashion around the material identifier code discussed above.

Three specific things were considered in establishing the data format: (1) the description and characterization of the materials for which data are shown in the system, (2) the data elements for the individual tests, and (3) the styles of presentation of the data when accessed following its compilation and inclusion in the database.

Considerable attention was given to the need to have adequate background on the materials so that comparisons of performance characteristics may be made reliably. The impact of such considerations is the inclusion of much more information than is likely to be desired by most users most of the time. However the result is the ability to track down a great amount of additional detail

for those situations where it may be necessary to ensure that comparisons are meaningful. Examples include the elemental composition of individual lots, the fabrication histories of the individual lots, and the procedures used in producing the welded samples.

A major advantage of the particular format in Table 5 is its essential consistency with those of other databases being built by MPC and MPD Network for steels for other applications, notably the STEELTUF database (7). Utilization of such a format, even with substantial modification, assures the ability to expand, combine and/or compare readily with these other sources.

Compilation of Data: In order to maximize the efficiency and consistency of compilation of data for this data bank, standard data collection formats were developed. The format used for this purpose in the current program is presented in Table 5.

6 Sources of Data

The sources of data used in building the data bank included:

- Raw test results from ABS
- Raw rest results from material suppliers
- Individual test results from papers and technical reports published by:
 - ASTM Special Technical Publications and Journals
 - Materials Properties Council
 - Naval Research laboratories
 - Welding Research Council
 - Electric Power Research Institute
 - Ship Structures Committees
 - American Welding Society
 - Nippon Kokan
 - United Kingdom Atomic Energy Association
 - American Society of Mechanical Engineers
 - Universities

7 Procedures Employed in Building the Data Bank

The following basic steps were employed in building the MARTUF database:

1. Identification and procurement of data sources.
2. Review of document and completion of data compilation formats.
3. Transcription of data from source to *LOTUS 1-2-3* tabular format from information on compilation formats.
4. Development of a mapping program, and loading of file from *LOTUS 1-2-3* tabular format to a main-frame machine-readable database.

5. Mapping of the machine-readable form to print hardcopy handbook quality compilations.

The machine-readable version of the data bank was built and maintained at Stanford University in the *SPIRES* database management system (dbms). This software was developed at Stanford for library management and bibliographic search and retrieval purposes.

Preparation of the hardcopy database was accomplished under subcontract to Mr. William L. Anderson, of Elements Research, Inc., 2850 Middlefield Rd. #126, Palo Alto, CA 94306. The document was typeset in $\text{T}_{\text{E}}\text{X}$ and PostScript.¹

8 Summary

The *Ship Structures Committee* has sponsored the development of a data bank covering the toughness of steels for marine applications. Effort focused on the identification and procurement of sources of data containing quantitative toughness data, and the development from those data of a well-documented computerized data bank available to a wide range of engineers and material scientists. Included were raw data from material suppliers and data from papers and technical reports published by a variety of organizations.

The principal focus was on Tensile, Charpy V notched bar impact values, fracture toughness (JIC), NDTT, and DT energies; other toughness parameters were included if available for the same lots of material. The materials include steels identified by the Project Technical Committee representing the sponsoring agencies.

About 1000 records representing approximately 10,000 tests of eleven steels are included in this prototype version of the data bank. Standard procedures now exist for efficient addition of data for other alloys and properties.

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T_EX is a trademark of the American Mathematical Society.
PostScript is a trademark of Adobe Systems Incorporation.

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TABLE 1

MARINE STRUCTURAL TOUGHNESS DATA BANK

<u>COMMON NAME</u>	<u>ASTM SPEC</u>	<u>UNS NUMBER</u>	<u>PRIORITY</u>
HY80	A543 Gr C(1)	K31820	1-1
A710-A	A710 Gr A	K20747	1-2
CG A537M	A537 Cl 1	K12437	1-3
ABS-B	A131 Gr B	K02102	1-4
API 5L Gr X70	-	-	1-5
HSLA 80	-	-	1-6
ABS-EH36	A131 Gr EH36	K11852	1-7
A514E	A514 Gr E	K21604	1-8
A36	A36	-	1-9
BS 4360 Gr 50D	-	-	1-10
HY100	-	K32045	1-11
A588-81 Gr A	A588 GR A	K11430	1-12
A588 Gr B	A588 Gr B	K12043	1-12
A588 Gr C	A588 Gr C	K11538	1-12
A537-A	A537 Gr A	K02400	1-13
API 5L Gr X60	-	-	1-14
A656-70	A656 Gr 70	K11804	1-15
A572 Gr 50	A572 Gr 50	-	2-1
A678 Gr D	A678 Gr D	-	2-2
DIN 17100 St 52.3	-	-	2-3
JIS G3016	-	-	2-4
ABS-E	A131 Gr E	K01801	2-5
ABS DH36	A131 Gr DH36	-	2-6
A514A	A514 Gr A	K11856	3-1
A514F	A514 Gr F	K11576	3-2
A514P	A514 Gr P	K21650	3-3
A537-1	A537 Cl 1	K12437	3-4
A537-2	A537 Cl 2	K12437	3-5
A588	A588	K12040	3-6
A588-71 Gr F	A588 Gr F	K11541	3-7
ABS-CS	A131 Gr CS	K01601	3-8
ABS-DS	A131 Gr DS	K01601	3-9
ABS-AH32	A131 Gr AH32	K11846	3-10
ABS-EH32	A131 Gr EH32	K11846	3-11

Priorities: 1-1,2 etc
2
3

Technical Committee Priority 1 List
Technical Committee Priority 2 List
Other Grades of Alloys in Priority 1 List

Table 2 - Comparisons of Tensile Property and Composition Limits For Some Steels of Interest For Marine Applications

ALLOY DESIGNATIONS	SPECIFIED MINIMUM		SPECIFIED COMPOSITION, element, per cent																
	UTS	YS or YP	C		Mn		P		S		Si		Ni		Cr		Mo		
	ksi	ksi	Max.	Min.	Max.	Min.	Max.	Max.	Max.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
A514 Gr E	100	90	0.20	0.12	0.70	0.40	0.035	0.040	0.20	-	-	-	-	2.00	1.40	0.60	0.40		
A517 Gr E	115	100	0.20	0.12	0.70	0.40	0.035	0.040	0.35	0.20	-	-	-	2.00	1.40	0.60	0.40		
A543 Type C Class 2	115	100	0.23	-	0.40	-	0.020	0.020	0.40	0.20	3.25	2.25	1.80	1.20	0.60	0.45			
HY-100	100	100	0.20	-	0.40	0.10	0.025	0.025	0.35	0.15	3.50	2.25	1.80	1.00	0.60	0.20			
HY-80	80	80	0.18	-	0.40	0.10	0.025	0.025	0.35	0.15	3.25	2.00	1.50	1.00	0.60	0.20			
A543 Type C Class 1	105	85	0.23	-	0.40	-	0.020	0.020	0.40	0.20	3.25	2.25	1.80	1.20	0.60	0.45			
A710 Gr A Class 2	72	65	0.07	-	0.70	0.40	0.025	0.025	0.40	-	1.00	0.70	0.90	0.60	0.25	0.15			
A710 Gr A Class 3	85	75	0.07	-	0.70	0.40	0.025	0.025	0.40	-	1.00	0.70	0.90	0.60	0.25	0.15			
HSLA 80 (MIL-S-24645)		80	0.07	-	0.70	0.40	0.025	0.030	0.70	-	1.00	0.70	0.90	0.60	0.25	0.15			
CG-537M			0.16	-	1.50	0.90	0.035	0.040	0.35	0.15	0.25	-	-	0.25	-	0.08	-		
A537/A537M Class 1	70	50	0.24	-	1.35	0.70	0.035	0.040	0.50	0.15	0.25	-	-	0.25	-	0.08	-		
A537/A537M Class 2	80	60	0.24	-	1.35	0.70	0.035	0.040	0.50	0.15	0.25	-	-	0.25	-	0.08	-		
ABS EH36	71	51	0.18	-	1.60	0.90	0.040	0.040	0.50	0.10	0.40	-	-	0.25	-	0.08	-		
A737 Gr C	80	60	0.22	-	1.50	1.15	0.035	0.030	0.50	0.15	-	-	-	-	-	-	-	-	-
A656 Gr 70	80	70	0.18	-	1.65	-	0.025	0.030	0.35	-	-	-	-	-	-	0.35	-	-	-
API 5L Gr X60				-	1.60	-	0.040	0.050	-	-	0.50	-	-	-	-	-	-	-	-
API 5L Gr X70			0.15	-	1.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A36	58	36	0.25	-	1.20	0.80	0.040	0.050	-	-	-	-	-	-	-	-	-	-	-
BS4360 Gr 50D			0.15	-	1.35	0.80	0.040	0.050	0.30	0.15	0.50	0.25	0.50	0.30	-	-	-	-	-
A588 Gr C	70	50	0.15	-	1.35	0.80	0.040	0.050	0.30	0.15	0.50	0.25	0.50	0.30	-	-	-	-	-
MS-B/ABS Gr B	58	34	0.21	-	1.10	0.80	0.040	0.040	0.35	-	-	-	-	-	-	-	-	-	-
A572 Gr 50 Type 1	65	50	0.23	-	1.65	-	0.040	0.050	0.40	-	-	-	-	-	-	-	-	-	-
A633 Gr A	63	42	0.18	-	1.35	1.00	0.040	0.050	0.50	0.15	-	-	-	-	-	-	-	-	-
A678 Gr C	90	70	0.22	-	1.60	1.00	0.040	0.050	0.50	0.20	-	-	-	-	-	-	-	-	-
ABS E	58	34	0.18	-	1.35	0.70	0.040	0.040	0.35	0.10	-	-	-	-	-	-	-	-	-

ALLOY DESIGNATIONS	SPECIFIED MINIMUM		SPECIFIED COMPOSITION, element, per cent													
	UTS	YS or YP	Cu		V		CP(Nb)		Ti		B		Al		N	
	ksi	ksi	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Min.	Max.	Min.	Min.
A514 Gr E	100	90	-	-	-	-	-	-	0.10	0.04	0.005	0.0015	-	-	-	-
A517 Gr E	115	100	0.40	0.20	-	-	-	-	0.10	0.04	0.01	0.00	-	-	-	-
A543 Type C Class 2	115	100	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-
HY-100		100	0.25	-	-	-	-	-	-	-	-	-	-	-	-	-
HY-80		80	0.25	-	-	-	-	-	-	-	-	-	-	-	-	-
A543 Type C Class 1	105	85	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-
A710 Gr A Class 2	72	65	1.30	1.00	-	-	0.02	-	-	-	-	-	-	-	-	-
A710 Gr A Class 3	85	75	1.30	1.00	-	-	0.02	-	-	-	-	-	-	-	-	-
HSLA 80 (MIL-S-24645)		80	1.30	1.00	-	-	-	-	-	-	-	-	-	-	-	-
CG-537M			0.35	-	-	-	-	-	-	-	-	-	-	-	-	-
A537/A537M Class 1	70	50	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-
A537/A537M Class 2	80	60	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-
ABS EH36	71	51	0.35	-	0.10	-	0.05	-	-	-	-	-	-	-	-	-
A737 Gr C	80	60	-	-	0.11	0.04	0.05	-	-	-	-	-	-	-	-	0.030
A656 Gr 70	80	70	-	-	-	-	0.07	0.020	-	-	-	-	-	-	0.020	0.030
API 5L Gr X60			-	-	0.02	-	0.05	-	-	-	-	-	-	-	-	-
API 5L Gr X70			-	-	0.10	-	0.05	-	-	-	-	-	-	-	-	-
A36	58	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BS4360 Gr 50D			0.50	0.20	0.10	0.01	-	-	-	-	-	-	-	-	-	-
A588 Gr C	70	50	0.50	0.20	0.10	0.01	-	-	-	-	-	-	-	-	-	-
MS-B/ABS Gr B	58	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A572 Gr 50 Type 1	65	50	-	0.20	-	-	0.05	0.005	-	-	-	-	-	-	-	-
A633 Gr A	63	42	-	-	-	-	0.05	-	-	-	-	-	-	-	-	-
A678 Gr C	90	70	-	0.20	-	-	-	-	-	-	-	-	-	-	-	-
ABS E	58	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: Where composition or tensile properties vary with thickness, values are for 1-in. plate



10 Annex I: Summary and Directory of Data Sheets

Summary and General Introduction

Table A - List of Alloys and Directory for Data Bank

Table B - Explanation of Material Codes

Table C - List of Abbreviations and Symbols in Data Tables

Table D - List Abbreviations for Data References

10.1 Summary and General Description of Marine Toughness Data Bank

The Marine Toughness Data Bank is a compilation of raw, individual test data for steels of interest to the marine industry. The data are organized in the attached pages by alloy and where possible by grade of the alloy. Data for individual lots of material are collected together, with a cover page providing the background identification, composition, fabricating history, and, in the case of welds, the weld procedures. Also included on the initial cover page for each individual lot are the tensile properties whenever those were available. Following the tensile properties are one or more of the following types of test results:

- Tensile tests per ASTM Method E 8
- Charpy V-notched bar impact (CVN) tests per ASTM Method E 23
- Fracture toughness (J-integral, JIc) tests per ASTM Method E 813
- Nil-ductility-transition temperature (NDTT) tests per ASTM Method E 208
- Dynamic tear (DT) tests per ASTM Method E 604
- Drop weight tear test per ASTM Method E 436

over a range (more than two) temperatures, the data are plotted as a function of temperature on uniform sized plots so that data from may be readily compared from lot to lot and alloy to alloy.

In general, the data are presented in the original units systems (SI - International Standard, or Engineering) in which they were reported. However, once again to facilitate comparisons, all plots are presented to uniform scales with both sets of units present. There were a few cases in which older metric unit systems were utilized, and in these cases, the values are converted to the SI system for presentation.

The information on the following pages will provide additional assistance in interpreting certain of the abbreviations and codes used in compiling the data.

10.2 Table A - List of Alloys and Directory for Data Bank

Alloy Designation	Material Code (See Table B)	Page Number
ABS-B	004	1000
ABS-EH32	032	2000
ABS-EH36	007	2100
A36	009	3100
CG A537M	003	7100
A537 CL1	003	7300
A572 Gr 50	016	7600
A588	012	8000
A710	002	9400
BS4360 Gr 50D	010	13800
HY80	001	16600
HY100	009	19500

10.3 Table B - Explanation of Material Codes

In logging the data for inclusion in the Marine Toughness Data Bank, a three-part identification scheme was used, in which:

- the first three digits identify the alloy;
- the second set of three digits identify the specific heat; and
- the final two digits identify whether the test sample was parent (base) metal, weld metal or heat-affected zone (HAZ), plus in the latter case the approximate distance of the HAZ from the weld line. In the case of welds, it was often useful to add one or more letters to document some other welding variable such as a postweld thermal treatment.

Thus, the complete material code for unwelded materials would be of the following form:

XXX.YYY.01

Where:

XXX. -Alloy Identifier, from priority code (Table 1)
 YYY. -Heat Number, sequential number

And for a welded material it would be of this form:

XXX.YYY.ZZ/WWW

where

XXX. -Alloy Identifier, from priority code (Table 1)
 YYY. -Heat Number, sequential number
 ZZ -Sample Descriptor, as follows:
 .01 - Base Metal
 .02 - On fusion line
 .03 - 1 mm into HAZ
 .04 - 3 mm into HAZ
 .05 - 5 mm into HAZ
 .06 - 7 mm into HAZ
 .07 - 9 mm into HAZ
 .08 - 11 mm into HAZ
 .09 - All weld metal

WWW -Weld descriptors
 A - As welded
 S - Stress relieved after welding

In either case (parent/base material or weld), one or more numbers may follow these codes (without any space) indicating different pieces or minor variations in treatments, which may be deduced by looking at the detailed composition, fabrication or welding history.

10.4 Table C - Symbols and Abbreviations Used in Data Bank

Abbreviations for Heat Treatment and Final Processing:

A	Austenitized
B	Brine quenched
C	Cold rolled
D	Double normalized
F	Hot rolled
G	Hot forged
K	Aged
N	Normalized
P	Thermo-mechanical process
R	Continuous rolled
Q	Quenched
S	Stress-relieved
T	Tempered
W	Welded

Abbreviations for Alloying Elements:

C	Carbon	Mn	Manganese
P	Phosphorus	S	Sulfur
Si	Silicon	Cr	Chromium
Ni	Nickel	Mo	Molybdenum
V	Vanadium	Cu	Copper
Cb	Columbium	Ti	Titanium
B	Boron	Al	Aluminum
N	Nitrogen		

Abbreviations for Welding Procedures:

Weld type:	SAW	Submerged arc weld
	SMAW	Shielded metal arc weld
	TSAW	Tandem shielded submerged arc weld
	ESW	Electroslag weld
	NGESW	Narrow gap electroslag weld
Weld position:	IG	Downhand
	1G	Downhand
	2G	Horizontal
	3G	Vertical
	4G	Overhead

Abbreviations for Location of Test Sample:

T	Top	B	Bottom
---	-----	---	--------

Abbreviations for Specimen Orientation:

For tensile specimens:

L	Longitudinal
T	Long Transverse
S	Short Transverse

For all other specimens: two letter codes are used, with the first letter indicating the direction normal to the fracture plane; and the second letter indicating the expected direction of crack growth on the fracture plane.

The letters are:

L	Longitudinal
T	Long transverse
S	Short transverse

The common combinations are:

L-T,	L-S
T-L,	T-S
S-L,	S-T

Abbreviations for Table Column Headings:

Break?	Did specimen fracture completely?
COD _{Ic}	Critical COD
COD _i	Initial COD
CVN Energy	Charpy V Energy
Crack lgth	Crack Length
Curve	Curve Shape
DT Energy	Dynamic Tear Energy
E	Tensile Modulus
Filler	Filler Alloy
Frac Apear	Appearance
Fracture?	Did Specimen Fracture?
Gage Lngth	Gage Length
Inv Basis	Reason for Invalid
Is Valid?	Valid K _{Ic} ?
JI	Initial JI
J _{max}	Maximum J, J _{max}
Lat Expans	Lateral Expansion
Load Rate	Loading Rate
Load Type	Loading Type
NDTT	Nil Ductility Transition Temperature
Notch Prep	Notch Preparation
Orien	Orientation
RA	Reduction in Area
Shear	Shear Fracture
Spec Thick	Specimen Thickness
Spec Type	Specimen Type
Split?	Did Specimen Split?
Std Method	Standard Method Designation
Std Year	Year Standard Issued
TYP	Tensile Yield Point
TYS	Tensile Yield Strength
TYS Offset	Tensile Strength Offset
Tear Mod	Tearing Modulus
Test Temp	Test Temperature
UTS	Tensile Strength
Uniform El	Uniform Elongation



10.5 Table D - List Abbreviations for Data Source References:

- 004-2 — “Approval Testing of Ship Steel Grades A, B, D and E, Produced via the Continuous Slab Caster Process,” Australian Iron and Steel Property Ltd., 1980
- 007-1 — Kobe Steel Reports on “Quantitative Examination for Approval of Higher Strength Hull Structural Steel Plate Quench and Temper Type,” to ABS, Kobe Steel Ltd., Kakogawa Plant, 1972
- 007-4 — Sumitomo Test Report on “Approval of Higher Strength Hull Steel Plates Rolled from Contiguously Cast Slab” to ABS, Sumitomo Metal Industries Ltd., Kashima Steel Works, November 1972
- 1010 — Lukens Steel Company, Data Report Project 1010
- 1211 — Lukens Steel Company, Data Report Project 1211
- 3200 — Lukens Steel Company, Data Report Project 3200
- 3201 — Lukens Steel Company, Data Report Project 3201
- 3202 — Lukens Steel Company, Data Report Project 3202
- 3400 — Lukens Steel Company, Data Report Project 3400
- 3530 — Lukens Steel Company, Data Report Project 3530
- ARMCO-MPC — ARMCO Steel Data Submitted for MPC Survey
- KONKOL-1 — Konkol, P. J., Effects of Long-Time Post Weld Heat Treatment on the Properties of Constructional Steels, WRC Bulletin 330, January 1988
- METZ/MPC-13 — Metz, P. O., “Toughness of C-Mn Structural Steels,” in Fracture Toughness of Wrought and Cast Steels, ASME Publication MPC-13, 1980
- RP1120 — Lukens Steel Company, Data Report Project RP1120
- S-1971 — “Sumitomo Metal Industries Approval Test Report of Hull and Steel Plates Rolled from Continuously Cast Slab, Grades A, R, B, C, D and E,” Sumitomo Metal Industries Ltd., Wakayama Steel Works, April 15, 1971
- SH-01 — Properties of Normalized Steel Plates (Equivalent to BS4360 Gr. 50D) with Z Properties, Sumitomo Heavy Industries
- SSC276 — Francis, P. H., Cook, T. S. and Nagy, A., Fracture Behavior Characterization of Ship Steels and Weldments, SSC-276, Final Report on Project SR-1224 (Fracture Criteria), Ship Structures Committee, U. S. Coast Guard Headquarters, 1978
- USN-1 — U. S. Navy First Article Qualification Processing Information for Indicated Heat
- USN 4/7 — U. S. Navy Technical Report, MPC Archival Record 4/7
- USN 5/7 — U. S. Navy Technical Report, MPC Archival Record 5/7

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USN 5/9 — U. S. Navy Technical Report, MPC Archival Record 5/9

USN 6/9 — U. S. Navy Technical Report, MPC Archival Record 6/9

USN 7/9 — U. S. Navy Technical Report, MPC Archival Record 7/9

USN 8/9 — U. S. Navy Technical Report, MPC Archival Record 8/9

USN 9/9 — U. S. Navy Technical Report, MPC Archival Record 9/9

WELLMAN-WRC — Wellman, G. W. *et al*, "Specimen Thickness Effects for Elastic Plastic CTOD Fracture Specimens of an A36 Steel," WRC Bulletin 328, Nov. 1987

WJ 3/87 — "Welded HY-80 Steel for Australian Warships," Welding Journal 66(3), March 1987, pp. 33-44

WJ 7/87 — Rodgers, K. J. and Lochhead, J. C., "Self-Shielded Flux Cored Arc Welding - The Route to Good Fracture Toughness," Welding Journal 66(7), July 1987, pp. 49-59

11 Annex II: Martuf on MPD Network

As noted in the body of this document, a machine-readable and searchable version of the Marine Structural Toughness Data Bank, known as MARTUF, has been developed and is accessible via the National Materials Property Data Network (*MPD Network*) on *STN International*. For more information, contact:

J. G. Kaufman, President
National Materials Property Data Network, Inc.
2540 Olentangy River Road
Columbus, Ohio 43202

12 Annex III: Data Collection Formats

The following pages contain formats used during the collection of data for the Marine Toughness Data Bank.

FORMATS.TXT

For File Use only
Entered into _____WK1
lines _____ to _____
Date _____ 19 _____

Information included: Wld, Ten, FT, CV, NDT, DWT, DT, MRL
WORKSHEETS FOR U. S. COAST GUARD DATABASE (based on marindbs: 12/30/87)
FRACTURE PROPERTIES OF STEELS FOR MARINE APPLICATIONS

BACKGROUND

- 0-1 Material Code _____
- *0-1a Common material name _____
- 0-1b UNS desig. _____ n.r. _____ n.a. _____ n.y.
- 0-1c ASTM specification no. _____ n.r. _____ n.a. _____ n.y.
- 0-1d AISI desig. _____ n.r. _____ n.a. _____ n.y.
- 0-1e Military spec. _____ n.r. _____ n.a. _____ n.y.
- 0-1f Other designation _____ n.r. _____ n.a. _____ n.y.
- 0-2a Base Metal _____ WM-Wrought metal _____ CM-Cast metal _____ WJ-Welded joint only
- *0-2b Basic Form _____ P-Plate _____ A-Angle _____ C-Channel _____ W-Web of shape
_____ T-Pipe _____ B-Bar _____ S-Shape _____ F-Flange of shape
_____ n.r. _____ n.a. _____ n.y.
- *0-3 Thickness _____ mm _____ in. _____ See _____
_____ n.r. _____ n.a. _____ n.y.
- 0-4 Composition type _____ S-refer to specification
_____ N-nominal (not measured)
_____ A-actual;
- 0-4aa Composition Position _____ T-Top, _____ B-Bottom, _____ L-Ladle, _____ W-Weld
_____ n.r. _____ n.a. _____ n.y.
- 0-4a-o Actual Composition _____ See _____
- 0-4p Composition Comments _____
- 0-5 Total Processing _____
(Choose letters to indicate steps and order of treatment)
- | | |
|-------------------------------|-----------------------------------|
| _____ A-austenitized | _____ N-normalized |
| _____ B-brine quenched from A | _____ P-thermo-mechanical process |
| _____ C-cold working | _____ R-continuous rolled |
| _____ D-double normalized | _____ Q-quenched |
| _____ F-hot rolled | _____ S-stress relieved |
| _____ G-hot forged | _____ T-tempered |
| _____ K-aged | _____ W-welded |
- _____ n.r. _____ n.a. _____ n.y.
- *0-6 Producer's Heat Lot Number _____
_____ n.r. _____ n.a. _____ n.y. _____ See _____
- 0-7 Producer (name of producing company) _____ n.r. _____ n.a. _____ n.y.
- 0-7a Year of production _____ n.r. _____ n.a. _____ n.y.
- 0-8 Additional information ? _____
- 0-9 Source of data/laboratory _____
_____ n.r. _____ n.a. _____ n.y.
- *0-10 Source of data/reference _____
_____ n.r. _____ n.a. _____ n.y.
- 0-11 Melting practice _____ n.r. _____ n.a. _____ n.y.
- 0-12 Ingot position _____ top _____ middle _____ bottom _____ cont. cast. _____ n.r. _____ n.a. _____ n.y.
- 0-13 Killing _____ n.r. _____ n.a. _____ n.y.
- 0-14 Process temp. _____ degC _____ degF _____ degK
_____ n.r. _____ n.a. _____ n.y. _____ See _____
- 0-15 Process time _____ hr _____ n.r. _____ n.a. _____ n.y. _____ See _____
- 0-16 Rolling conditions _____ % reduction, total _____ n.r. _____ n.a. _____ n.y.
- *0-17 Final processing steps (use one or two letters)
- | | |
|-------------------------------|-----------------------------------|
| _____ A-austenitized | _____ N-normalized |
| _____ B-brine quenched from A | _____ P-thermo-mechanical process |
| _____ C-cold working | _____ R-continuous rolled |
| _____ D-double normalized | _____ Q-quenched |
| _____ F-hot rolled | _____ S-stress relieved |
| _____ G-hot forged | _____ T-tempered |
| _____ K-aged | _____ W-welded |
- 0-18 Final heat treat temp. _____ degC _____ degF _____ degK
_____ n.r. _____ n.a. _____ n.y. _____ See _____
- 0-19 Final heat treat time _____ hr _____ n.r. _____ n.a. _____ n.y. _____ See _____
- 0-20 Cold work strain _____ % _____ n.r. _____ n.a. _____ n.y. _____ See _____
- 0-21 S/R or Aging temp. _____ degC _____ degF _____ degK _____ See _____
_____ n.r. _____ n.a. _____ n.y.
- 0-22 S/R or Aging time _____ hr _____ n.r. _____ n.a. _____ n.y. _____ See _____
- 0-23 Location _____

W-0 Material Key _____
W-1 Weld Code _____
W-2 Welding Process
____ SAW ____ NGGMA ____ GMA ____ ESW
____ SMA ____ NGSAW ____ GTA ____ EBW
____ FCA ____ TSAW ____ PAW ____ n.r. ____ n.y.
W-3 Base Metal Thickness ____ mm ____ in ____ n.r. ____ n.a. ____ n.y.
W-4 Welding Position ____ n.r. ____ n.a. ____ n.y.
W-5 Preheat temp. ____ degC ____ degF ____ degK ____ n.r. ____ n.a. ____ n.y.
W-6 Gap ____ mm ____ in ____ n.r. ____ n.a. ____ n.y.
W-7 Interpass temp. ____ degC ____ degF ____ degK ____ n.r. ____ n.a. ____ n.y.
W-8 Number of passes ____ n.r. ____ n.a. ____ n.y.
W-9 Welding filler, Spec. and Grade _____
____ n.r. ____ n.a. ____ n.y.
W-10 Welding Filler Trade Name _____
W-11 Carbon content ____ n.r. ____ n.a. ____ n.y.
W-12 Filler size ____ mm ____ in ____ n.r. ____ n.a. ____ n.y.
W-13 Shielding Gas ____ A ____ He ____ M-mixed ____ n.r. ____ n.a. ____ n.y.
W-14 Voltage ____ volts ____ n.r. ____ n.a. ____ n.y.
W-15 Amperage ____ amps ____ n.r. ____ n.a. ____ n.y.
W-16 Polarity _____
W-17 Travel Speed ____ in/min ____ mm/min ____ n.r. ____ n.a. ____ n.y.
W-18 Heat Input/pass ____ KJoules/mm ____ KJoules/in ____ n.r. ____ n.a. ____ n.y.
W-19 Joint Prep. ____ V ____ U ____ K ____ S.B. ____ D.V. ____ D.U. ____ N.G. ____ n.r. ____ n.a. ____ n.y.
W-20 Number of sides welded ____ 1 ____ 2 ____ n.r. ____ n.a. ____ n.y.
W-21 Welded Specimen Codes
Location relative to weld: (See below)
____ 09-Weld Metal
____ 02-Fusion Line
____ 03-1mm HAZ
____ 04-3mm HAZ
____ 05-5mm HAZ
____ 06-7mm HAZ
____ 07-9mm HAZ
____ 08-11mm HAZ
____ 10-Transverse Section Test (All Zones)
____ 11-50%WM-50%HAZ
W-22 Location relative to surface: (See below)
____ F-Final surface
____ R-Back surface (root)
____ M-Mid thickness (not root)
____ C-Mid thickness (root)
____ B-Back surface (not root)
____ N-Full cross section
____ n.r. ____ n.a. ____ n.y.
W-23 Postweld heat treat. temp (See below) ____ degC ____ degF ____ degK
____ n.r. ____ n.a. ____ n.y.
W-24 Post-weld heat treatment time ____ hr (See below)
____ n.r. ____ n.a. ____ n.y.
W-25 Flux type _____
W-26 Flux Trade Name _____
W-27 Is actual weld deposit reported in 0-4? ____ Yes ____ No ____ n.y.
W-0 Material Key Code (See total number below)

-----MATERIAL KEY CODE-----				
	W-21 Loc/Weld	W-22 Location	W-23 PWHT Temp deg	W-24 PWHT Time hr.
-----	-----	-----	-----	-----
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.
-----	-----	-----	deg	hr.

- 1-0 Material Key _____
- 1-1 Type of test-tension _____
- 1-2 Test sample position n.r. n.a. n.y. See _____
 Surface, O/4T Quarter-thickness, 1/4T
 3/8 thickness Mid thickness, 1/2T
 Opposite surface, 1T Third quarter thickness, 3/4T
- *1-3 Orientation of specimen n.r. n.a. n.y. See _____
 L (longitudinal) T (long transverse) S (short transverse)
- 1-4 Type of specimen n.r. n.a. n.y. See _____
 Cylindrical Rectangular Full-section
- 1-5 Specimen diameter or thickness mm in See _____
 n.r. n.a. n.y.
- 1-6 Gage length mm in See _____
 n.r. n.a. n.y.
- 1-7 Rate of application of stress MPa/sec Ksi/sec in/in/sec
 n.r. n.a. n.y. See _____
- *1-8 Test temp. degC degF degK See _____
 n.r. n.a. n.y.
- *1-9 Tensile strength MPa Ksi See _____
 n.r. n.a. n.y.
- 1-10 Offset % for TYS measurement % See _____
 n.r. n.a. n.y.
- *1-11 Tensile yield strength MPa Ksi See _____
 n.r. n.a. n.y.
- 1-12 Tensile yield point MPa Ksi See _____
 n.r. n.a. n.y.
- 1-13 Uniform elongation % See _____
 n.r. n.a. n.y.
- 1-14 Total elongation % See _____
 n.r. n.a. n.y.
- 1-15 Reduction of area % See _____
 n.r. n.a. n.y.
- 1-16 Modulus of elasticity MPa*10**6 Ksi, etc See _____
 n.r. n.a. n.y.
- 1-17 Standard ASTM or other standard
 n.r. n.a. n.y.
- 1-18 Year of issue of test standard 19 See _____
 n.r. n.a. n.y.

2-0 Material Key

*2-1 Type of test (fracture toughness)

2-2 Position of specimen n.r. n.a. n.y. See

Full-thickness

Surface, 0/4T Quarter-thickness, 1/4T

3/8 thickness Mid thickness, 1/2T

Opposite surface, 1T Third quarter thickness, 3/4T

*2-3 Orientation of specimen See

L-T L-S L-C L-R T-L

T-S S-L S-T C-L C-R

R-C n.r. n.a. n.y.

*2-4 Type of specimen n.r. n.a. n.y. See

Compact Side-grooved compact Bend

Deep notch bend DCB WOL

*2-5 Thickness of specimen mm in See

n.r. n.a. n.y.

2-6 Initial crack length, average mm in See

n.r. n.a. n.y.

2-6a a/W See n.r. n.a. n.y.

2-7 Type of loading Slow Intermediate High Rate

n.r. n.a. n.y. See

2-8 (Kdot) Rate of loading See

n.r. n.a. n.y.

*2-9 Test temperature degC degF degK RT (20C)

See n.r. n.a. n.y.

*2-10 KQ n.r. n.a. n.y. See

2-11 K_{IC} n.r. n.a. n.y. See

*2-12 Valid measure of K_{IC}? yes no See

n.r. n.a. n.y.

*2-13 If invalid, reason See

(T)thickness (CL)crack length (FP)fatigue precrack

n.r. n.a. n.y.

2-14 J_{IC} units See

n.r. n.a. n.y.

2-15 Reported stress intensity factor from J_{IC} units MPa*m**0.5

n.r. n.a. n.y. See

2-16 Method of J_{IC} Calculation n.r. n.a. n.y. See

per Stand. modified Stand. other:

2-17 Initiation crack opening displacement mm in See

n.r. n.a. n.y.

2-18 Critical CTOD mm in See

n.r. n.a. n.y.

2-18a Is Critical CTOD c-cleavage u-cleavage preceded by tearing m-fibrous

2-19 Initiation J value units See

n.r. n.a. n.y.

2-20 Maximum J value units See

n.r. n.a. n.y.

2-20a No. of J specimens See n.r. n.a. n.y.

2-21 Tearing modulus units See

n.r. n.a. n.y.

2-22 Standard ASTM or other standard:

n.r. n.a. n.y.

2-23 Year of issue of test standard 19 See

n.r. n.a. n.y.

3-0 Material Key _____
 *3-1 Type of test: CVN-Charpy V notched bar impact
 PCV-Precracked Charpy V notched bar impact
 3-2 Position of specimen n.r. n.a. n.y. See
 Surface, 0/4T Quarter-thickness, 1/4T
 3/8 thickness, 3/8T Mid thickness, 1/2T
 Opposite surface, 1T Third quarter thickness, 3/4T
 *3-3 Type of specimen See
 Full: full-width Charpy V 1/2W: One-half width Charpy V
 2W: Twice-width Charpy V 1/4W: One-quarter width Charpy V
 *3-4 Orientation of specimen See
 L-T T-L L-C L-R L-S
 T-S S-L S-T C-L C-R
 R-C n.r. n.a. n.y.
 *3-5 Test temperature degC degF degK RT(20C)
 n.r. n.a. n.y. See
 3-6 Total energy to fracture J Ft-Lb See
 3-7 Lateral expansion mm mils See
 n.r. n.a. n.y.
 3-8 Shear fracture % Brittle fracture % See
 n.r. n.a. n.y.
 3-9 Did specimen fracture completely yes no assumed
 n.r. n.a. n.y. See
 3-10 Did specimen exhibit splitting yes no See
 n.r. n.a. n.y.
 3-11 Standard ASTM or other standard
 n.r. n.a. n.y.
 3-12 Year of issue of test standard 19 See
 n.r. n.a. n.y.

4-0 Material Key _____
 4-1 Type of test: MRL Crack arrest
 4-2 Position of specimen n.r. n.a. n.y. See
 Surface, 0/4T Quarter-thickness, 1/4T
 3/8 thickness Mid thickness, 1/2T
 Opposite surface, 1T Third quarter thickness, 3/4T
 4-3 Type of specimen DCB
 n.r. n.a. n.y. See
 4-4 Thickness of specimen mm in See
 n.r. n.a. n.y.
 4-5 Orientation of specimen See
 L-T L-S L-C L-R T-L
 T-S S-L S-T C-L C-R
 R-C n.r. n.a. n.y.
 4-6 Test temperature degC degF degK RT(20C)
 n.r. n.a. n.y. See
 4-7 Rate of loading Slow Intermediate High See
 n.r. n.a. n.y.
 4-8 KQ n.r. n.a. n.y. See
 4-9 Valid measure of KIC yes no See
 n.r. n.a. n.y.
 4-10 Reason for invalidity thickness See
 n.r. n.a. n.y.
 4-11 Crack arrest stress intensity See
 n.r. n.a. n.y.
 4-12 Standard ASTM or other standard
 n.r. n.a. n.y.
 4-13 Year of issue of test standard 19 See
 n.r. n.a. n.y.



13 Data Presentations for Marine Materials

Data presentations of all marine materials begin on page 1000. A brief table of contents is:

ABS-B	1000
ABS-EH32	2000
ABS-EH36	2100
A36	3100
CG A537M	7100
A537 CL1	7300
A572 Gr50	7600
A588	8000
A710	9400
BS4360 Gr50D	13800
HY80	16500
HY100	19500

On each report, background information and material properties are grouped into categories: *Description*, *Composition*, *Fabrication History*, *Weld*, and *Property Measurements*. Constant information is not repeated, but a note refers the reader to a previous page. Material property plots show both SI and traditional engineering units. A complete index appears at the end on page I (roman numeral). All nonnumeric values are indexed twice: as "*value variable*" and as "*variable, value*".

Marine Structural Toughness Data Bank

Material ABS-B

Page 1000.1

Description			
Material Code	004.001.01T	Material Name	ABS-B
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	25.0 mm	Composition Type	Actual
Composition Position	*	Lot ID	J131267
Reference	S-1971		

Composition			
C	0.140 %	Mn	0.79 %
P	0.018 %	S	0.013 %
Si	0.25 %	Cr	0.02 %
Ni	*	Mo	*
V	*	Cu	0.040 %
Cb	*	Ti	*
B	*	Al	0.002 %
N	0.0072 %	Other Components	None %

Fabrication History			
Heat Treatment	F	Producer	Sumitomo
Year Produced	1971	Addl Info	None
Source	Sumitomo	Melting Practice	BOF
Ingot Position	Concast	Killing Process	Silicon
Process Temperature	930 degC	Process Time	*
Rolling Conditions	89 %	Final Processing	A,R
Final Temperature	*	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	T

Property Measurements			
Test Type	Tensile	Gage Length	*
Loading Rate	*	Tensile Strength Offset	*
Tensile Yield Strength	*	Uniform Elongation	*
Tensile Modulus	*	Standard Method	*
Standard Year	*		

Posiüon	Orient	Spec Type	Spec Thick mm	Test Temp degC	UTS kgf/mm2	TYP kgf/mm2	Elongation %	RA %
1/2T	L	Flat	25	Room	45.9	30.5	30.1	66.5
1/2T	L	Flat	25	Room	47.7	33.0	26.3	69.2
1/2T	T	Flat	25	Room	46.8	31.9	29.1	68.1
1/2T	T	Flat	25	Room	48.5	33.0	26.2	68.1
*	T	Round	*	Room	45.8	32.8	30.0	71.6
*	T	Round	*	Room	47.2	32.5	29.0	68.9

* - not reported



Marine Structural Toughness Data Bank

Material ABS-B

Page 1000.2

Description	
Material Code	004.001.01B
Material Name	ABS-B
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	25.0 mm
Composition Type	Actual
Composition Position	*
Lot ID	J131267
Reference	S-1971

Composition			
C	0.140 %	Mn	0.08 %
P	0.018 %	S	0.013 %
Si	0.24 %	Cr	0.02 %
Ni	*	Mo	*
V	*	Cu	0.040 %
Cb	*	Ti	*
B	*	Al	0.002 %
N	0.0074 %	Other Components	None %

Fabrication History	
Heat Treatment	F
Producer	Sumitomo
Year Produced	1971
Addl Info	None
Source	Sumitomo
Melting Practice	BOF
Ingot Position	Concast
Killing Process	Silicon
Process Temperature	930 degC
Process Time	*
Rolling Conditions	89 %
Final Processing	A,R
Final Temperature	*
Final Time	*
Cold Work Strain	*
Aging Temperature	*
Aging Time	*
Location	B

Property Measurements	
Test Type	Tensile
Gage Length	*
Loading Rate	*
Tensile Strength Offset	*
Tensile Yield Strength	*
Uniform Elongation	*
Tensile Modulus	*
Standard Method	*
Standard Year	*

Position	Orient	Spec Type	Spec Thick mm	Test Temp degC	UTS kgf/mm2	TYP kgf/mm2	Elongation %	RA %
1/2T	L	Flat	25	Room	47.5	30.2	32.3	64.0
1/2T	L	Flat	25	Room	48.2	30.7	26.0	63.7
1/2T	T	Flat	25	Room	47.4	30.2	29.8	63.7
1/2T	T	Flat	25	Room	47.7	30.2	28.0	63.3
*	T	Round	*	Room	47.5	31.5	30.9	66.3
*	T	Round	*	Room	47.5	32.2	30.9	67.7

* - not reported

Marine Structural Toughness Data Bank

Material ABS-B

Page 1000.3

Description	
Material Code	004.001.01T
Material Name	ABS-B
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	25.0 mm
Composition Type	Actual
Composition Position	*
Lot ID	J131267
Reference	S-1971

Composition			
C	0.140 %	Mn	0.79 %
P	0.018 %	S	0.013 %
Si	0.25 %	Cr	0.02 %
Ni	*	Mo	*
V	*	Cu	0.040 %
Cb	*	Ti	*
B	*	Al	0.002 %
N	0.0072 %	Other Components	None %

Fabrication History			
Heat Treatment	F	Producer	Sumitomo
Year Produced	1971	Addl Info	None
Source	Sumitomo	Melting Practice	BOF
Ingot Position	Concast	Killing Process	Silicon
Process Temperature	930 degC	Process Time	*
Rolling Conditions	89 %	Final Processing	A,R
Final Temperature	*	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	T

Property Measurements			
Test Type	Charpy V Impact	Position	1/4T
Specimen Type	*	Lateral Expansion	*
Did Specimen Fracture?	Assumed	Did Specimen Split?	*
Standard Method	*	Standard Year	*

Orien	Test Temp degC	CVN Energy kgf-m	Shear %
L-T ◦	-40	0.6	6
L-T ◦	-40	2.1	12
L-T ◦	-40	3.0	12
L-T ◦	-30	0.8	11
L-T ◦	-30	2.6	17
L-T ◦	-30	4.2	23
L-T ◦	-20	5.3	31
L-T ◦	-20	6.4	29
L-T ◦	-20	6.8	36
L-T ◦	-15	7.1	32
L-T ◦	-15	7.2	32
L-T ◦	-15	7.2	36
L-T ◦	-10	7.4	40
L-T ◦	-10	9.5	55
L-T ◦	-10	9.9	54
L-T ◦	0	10.6	56
L-T ◦	0	13.7	69

* - not reported

(continued)

Marine Structural Toughness Data Bank

Material ABS-B

Page 1000.4

(continued)

Orien	Test Temp degC	CVN Energy kgf-m	Shear %
L-T ◊	0	8.1	47
L-T ◊	20	15.1	81
L-T ◊	20	15.9	85
L-T ◊	20	7.2	82
L-T ◊	40	16.1	91
L-T ◊	40	16.3	89
L-T ◊	40	16.6	91
T-L ▲	-40	1.8	9
T-L ▲	-40	2.0	12
T-L ▲	-40	2.1	12
T-L ▲	-30	2.4	17
T-L ▲	-30	2.4	17
T-L ▲	-30	2.4	17
T-L ▲	-20	2.6	21
T-L ▲	-20	2.9	17
T-L ▲	-20	3.1	25
T-L ▲	-15	3.0	24
T-L ▲	-15	3.1	29
T-L ▲	-15	3.6	24
T-L ▲	-10	3.0	32
T-L ▲	-10	3.1	31
T-L ▲	-10	3.5	34
T-L ▲	0	3.4	33
T-L ▲	0	3.7	35
T-L ▲	0	3.9	40
T-L ▲	20	5.9	56
T-L ▲	20	5.9	63
T-L ▲	20	6.4	59
T-L ▲	40	7.2	81
T-L ▲	40	7.8	87
T-L ▲	40	7.8	88

* - not reported

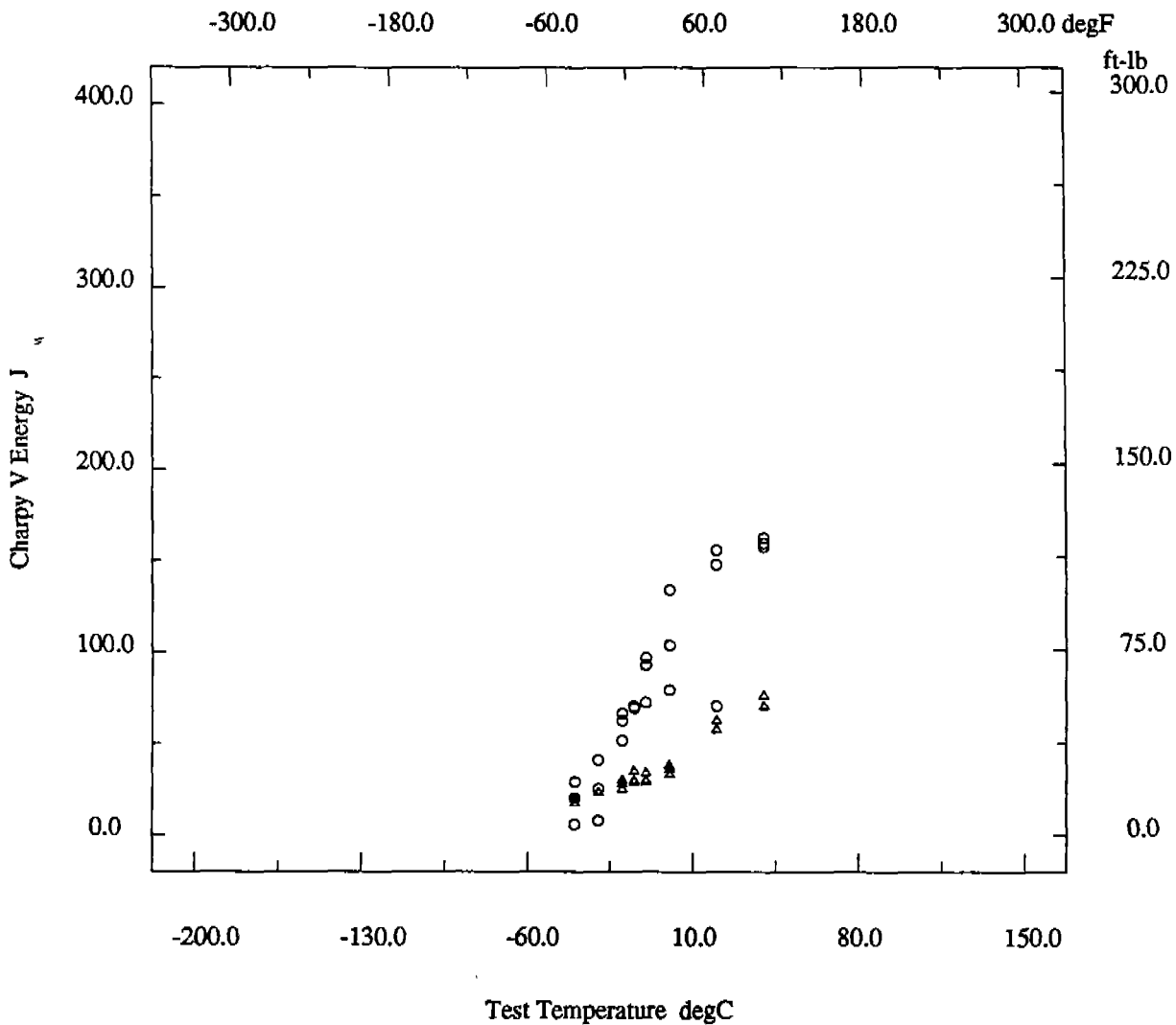
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Marine Structural Toughness Data Bank

Material ABS-B

Page 1000.5

Description			
Material Code	004.001.01T	Material Name	ABS-B
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	25.0 mm	Composition Type	Actual
Composition Position	*	Lot ID	J131267
Reference	S-1971		



* - not reported

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Marine Structural Toughness Data Bank

Material ABS-B

Page 1000.6

Description	
Material Code	004.001.01B
Material Name	ABS-B
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	25.0 mm
Composition Type	Actual
Composition Position	*
Lot ID	J131267
Reference	S-1971

Composition			
C	0.140 %	Mn	0.08 %
P	0.018 %	S	0.013 %
Si	0.24 %	Cr	0.02 %
Ni	*	Mo	*
V	*	Cu	0.040 %
Cb	*	Ti	*
B	*	Al	0.002 %
N	0.0074 %	Other Components	None %

Fabrication History			
Heat Treatment	F	Producer	Sumitomo
Year Produced	1971	Addl Info	None
Source	Sumitomo	Melting Practice	BOF
Ingot Position	Concast	Killing Process	Silicon
Process Temperature	930 degC	Process Time	*
Rolling Conditions	89 %	Final Processing	A,R
Final Temperature	*	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	B

Property Measurements			
Test Type	Charpy V Impact	Position	1/4T
Specimen Type	*	Lateral Expansion	*
Did Specimen Fracture?	Assumed	Did Specimen Split?	*
Standard Method	*	Standard Year	*

Orien	Test Temp degC	CVN Energy kgf-m	Shear %
L-T ◦	-40	0.6	97
L-T ◦	-40	0.7	94
L-T ◦	-40	1.4	73
L-T ◦	-30	0.3	94
L-T ◦	-30	0.9	89
L-T ◦	-30	2.3	91
L-T ◦	-20	2.3	83
L-T ◦	-20	3.1	80
L-T ◦	-20	7.2	71
L-T ◦	-15	1.2	86
L-T ◦	-15	4.9	77
L-T ◦	-15	5.2	77
L-T ◦	-10	3.9	80
L-T ◦	-10	4.4	80
L-T ◦	-10	5.6	74
L-T ◦	0	10.0	51
L-T ◦	0	8.4	58

* - not reported

(continued)



Marine Structural Toughness Data Bank

Material ABS-B

Page 1000.7

(continued)

Orien	Test Temp degC	CVN Energy kgf-m	Shear %
L-T ◊	0	8.5	57
L-T ◊	20	12.2	29
L-T ◊	20	13.2	31
L-T ◊	20	14.5	26
L-T ◊	40	14.5	19
L-T ◊	40	15.3	14
L-T ◊	40	15.9	17
T-L ▲	-40	0.7	97
T-L ▲	-40	0.9	94
T-L ▲	-40	1.5	94
T-L ▲	-30	1.0	91
T-L ▲	-30	1.8	88
T-L ▲	-30	2.7	83
T-L ▲	-20	2.0	83
T-L ▲	-20	2.9	80
T-L ▲	-20	2.9	85
T-L ▲	-15	2.9	80
T-L ▲	-15	3.5	78
T-L ▲	-15	3.7	80
T-L ▲	-10	3.4	80
T-L ▲	-10	3.4	80
T-L ▲	-10	3.6	80
T-L ▲	0	4.0	66
T-L ▲	0	4.0	70
T-L ▲	0	4.6	66
T-L ▲	20	5.9	52
T-L ▲	20	6.1	46
T-L ▲	20	6.1	47
T-L ▲	40	7.4	32
T-L ▲	40	7.7	35
T-L ▲	40	7.8	35

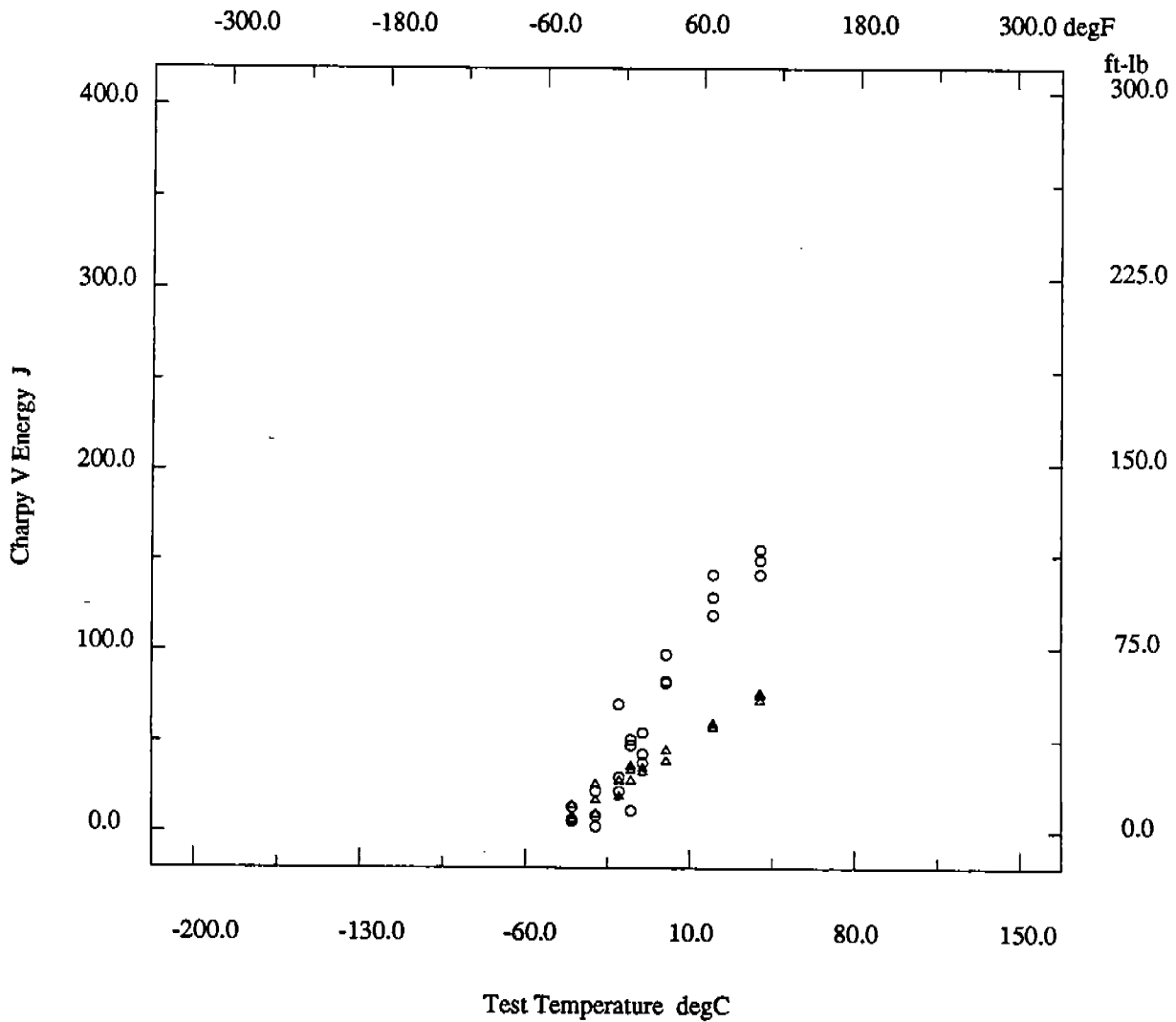
* - not reported

Marine Structural Toughness Data Bank

Material ABS-B

Page 1000.8

Description			
Material Code	004.001.01B	Material Name	ABS-B
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	25.0 mm	Composition Type	Actual
Composition Position	*	Lot ID	J131267
Reference	S-1971		



* - not reported

(4)

Marine Structural Toughness Data Bank

Material ABS-B

Page 1000.9

Description	
Material Code	004.001.01TS1
Material Name	ABS-B
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	25.0 mm
Composition Type	Actual
Composition Position	*
Lot ID	J131267
Reference	S-1971

Composition			
C	0.140 %	Mn	0.79 %
P	0.018 %	S	0.013 %
Si	0.25 %	Cr	0.02 %
Ni	*	Mo	*
V	*	Cu	0.040 %
Cb	*	Ti	*
B	*	Al	0.002 %
N	0.0072 %	Other Components	None %

Fabrication History			
Heat Treatment	F	Producer	Sumitomo
Year Produced	1971	Addl Info	None
Source	Sumitomo	Melting Practice	BOF
Ingot Position	Concast	Killing Process	Silicon
Process Temperature	930 degC	Process Time	*
Rolling Conditions	89 %	Final Processing	A,R
Final Temperature	*	Final Time	*
Cold Work Strain	5 %	Aging Temperature	350 degC
Aging Time	1.5 hr	Location	T

Property Measurements			
Test Type	Charpy V Impact	Position	1/4T
Specimen Type	*	Lateral Expansion	*
Did Specimen Fracture?	Assumed	Did Specimen Split?	*
Standard Method	*	Standard Year	*

Orien	Test Temp degC	CVN Energy kgf-m	Shear %
L-T ◦	-40	0.3	0
L-T ◦	-40	0.3	1
L-T ◦	-40	0.3	2
L-T ◦	-20	0.3	6
L-T ◦	-20	0.5	6
L-T ◦	-20	0.5	6
L-T ◦	-10	0.6	9
L-T ◦	-10	1.1	12
L-T ◦	-10	2.3	15
L-T ◦	0	1.0	11
L-T ◦	0	1.4	14
L-T ◦	0	2.4	18
L-T ◦	20	4.5	27
L-T ◦	20	4.5	27
L-T ◦	20	5.2	30
L-T ◦	40	5.2	48
L-T ◦	40	5.8	48

* - not reported

(continued)

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Marine Structural Toughness Data Bank

Material ABS-B

Page 1000.10

(continued)

Orien	Test Temp degC	CVN Energy kgf-m	Shear %
L-T ◦	40	7.0	58
L-T ◦	60	11.5	82
L-T ◦	60	11.8	84
L-T ◦	60	8.5	76
L-T ◦	80	13.9	87
L-T ◦	80	14.7	100
L-T ◦	80	14.9	100

* - not reported

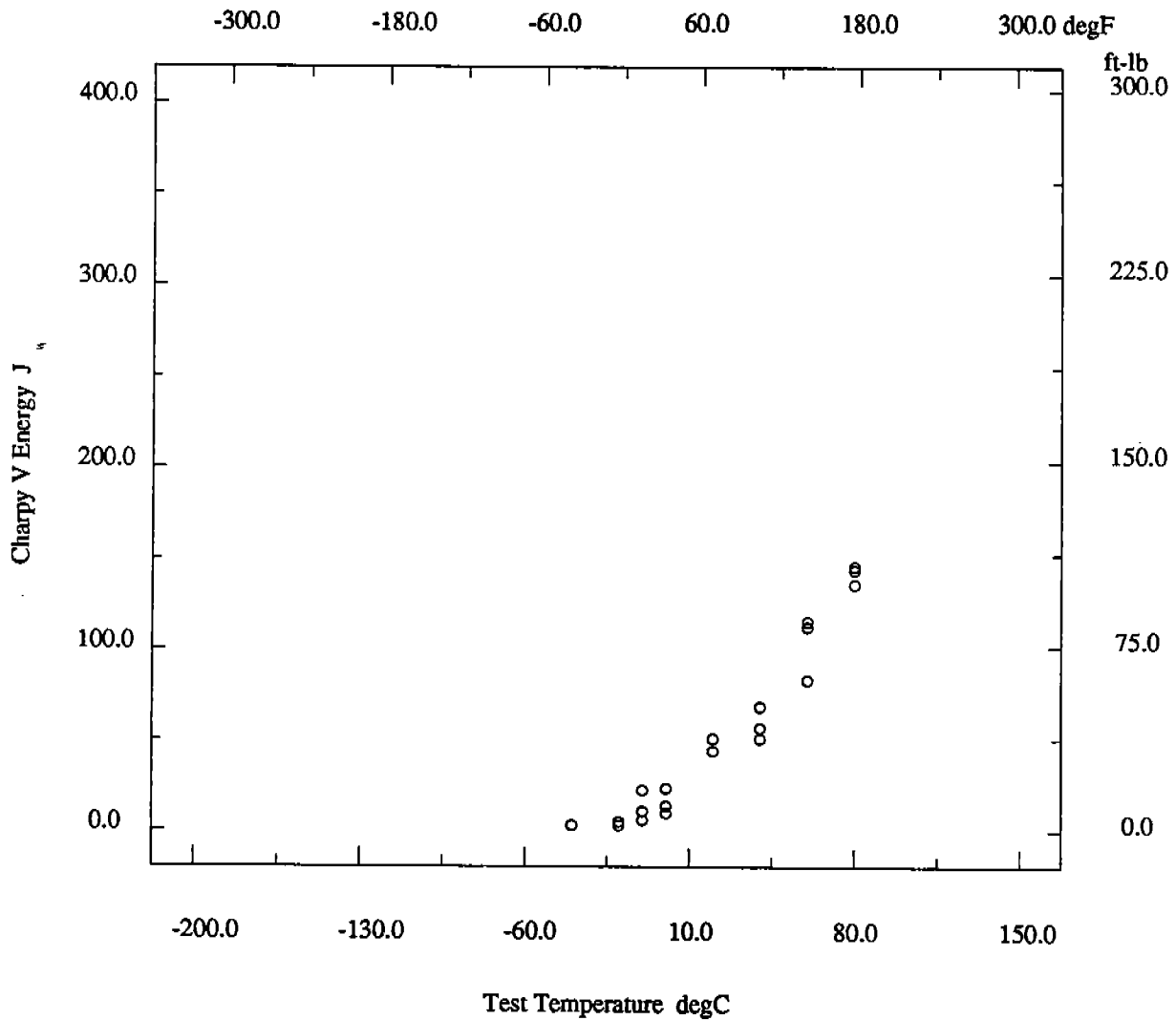
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Marine Structural Toughness Data Bank

Material ABS-B

Page 1000.11

Description			
Material Code	004.001.01TS1	Material Name	ABS-B
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	25.0 mm	Composition Type	Actual
Composition Position	*	Lot ID	J131267
Reference	S-1971		



* - not reported

(4)

Marine Structural Toughness Data Bank

Material ABS-B

Page 1000.12

Description			
Material Code	004.001.01TS2	Material Name	ABS-B
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	25.0 mm	Composition Type	Actual
Composition Position	*	Lot ID	J131267
Reference	S-1971		

Composition See Page 1000.9

Fabrication History			
Heat Treatment	F	Producer	Sumitomo
Year Produced	1971	Addl Info	None
Source	Sumitomo	Melting Practice	BOF
Ingot Position	Concast	Killing Process	Silicon
Process Temperature	930 degC	Process Time	*
Rolling Conditions	89 %	Final Processing	A,R
Final Temperature	*	Final Time	*
Cold Work Strain	10 %	Aging Temperature	250 degC
Aging Time	1.0 hr	Location	T

Property Measurements			
Test Type	Charpy V Impact	Position	1/4T
Specimen Type	*	Lateral Expansion	*
Did Specimen Fracture?	Assumed	Did Specimen Split?	*
Standard Method	*	Standard Year	*

Orien	Test Temp degC	CVN Energy kgf-m	Shear %
L-T ◦	-40	0.3	0
L-T ◦	-40	0.3	0
L-T ◦	-40	0.3	0
L-T ◦	-20	0.4	2
L-T ◦	-20	0.6	2
L-T ◦	-20	0.6	2
L-T ◦	-10	0.7	9
L-T ◦	-10	0.8	11
L-T ◦	-10	0.9	9
L-T ◦	0	0.8	11
L-T ◦	0	0.9	11
L-T ◦	0	1.6	11
L-T ◦	20	2.1	21
L-T ◦	20	3.5	27
L-T ◦	20	4.0	29
L-T ◦	40	3.9	36
L-T ◦	40	4.6	36
L-T ◦	40	5.7	47
L-T ◦	60	13.0	100
L-T ◦	60	13.3	100
L-T ◦	60	13.4	86
L-T ◦	80	13.4	100
L-T ◦	80	13.4	100
L-T ◦	80	13.7	100

* - not reported

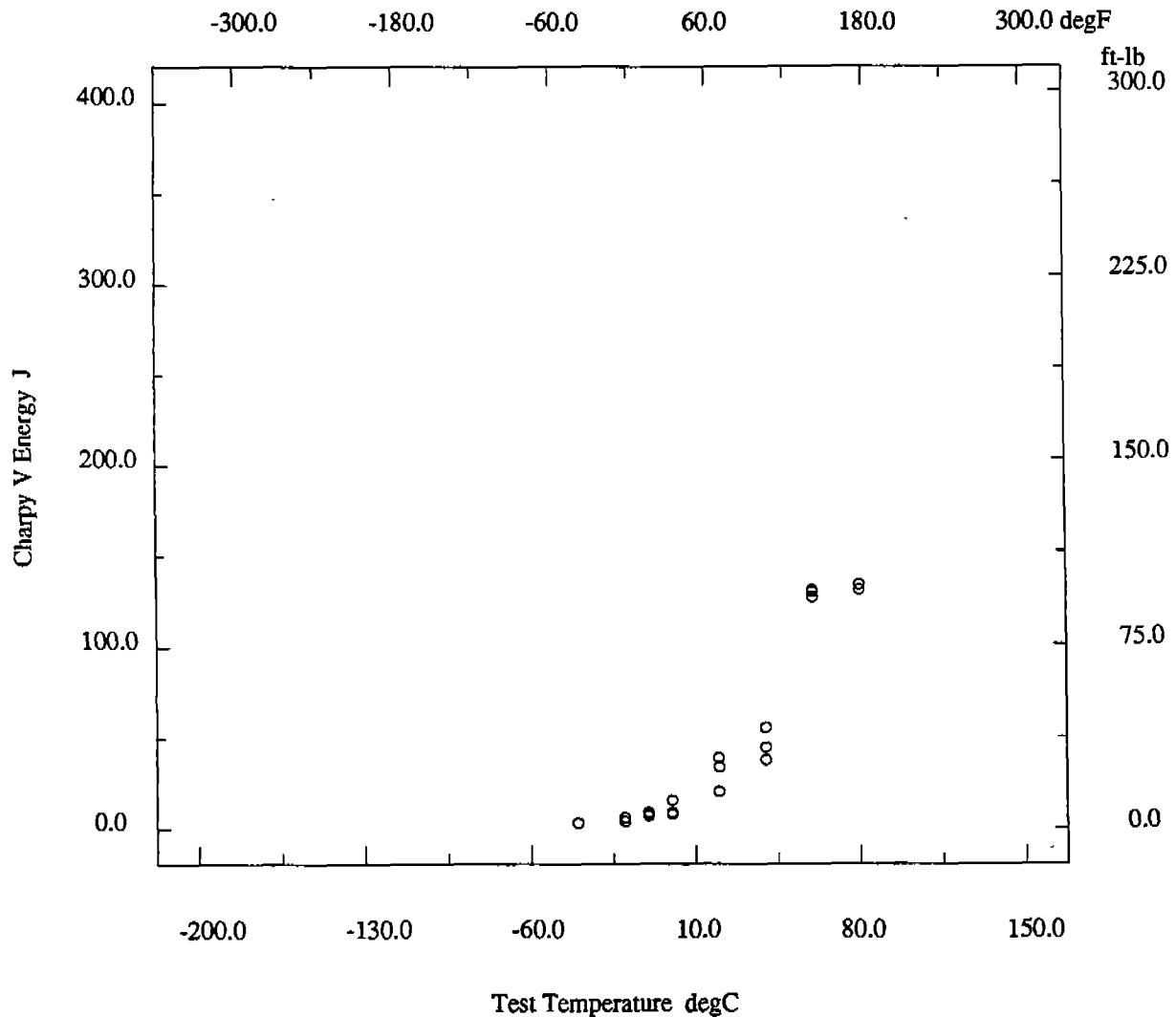


Marine Structural Toughness Data Bank

Material ABS-B

Page 1000.13

Description			
Material Code	004.001.01TS2	Material Name	ABS-B
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	25.0 mm	Composition Type	Actual
Composition Position	*	Lot ID	J131267
Reference	S-1971		



* - not reported



Marine Structural Toughness Data Bank

Material ABS-B

Page 1000.14

Description	
Material Code	004.001.01T
Material Name	ABS-B
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	25.0 mm
Composition Type	Actual
Composition Position	*
Lot ID	J131267
Reference	S-1971

Composition See Page 1000.9

Fabrication History	
Heat Treatment	F
Producer	Sumitomo
Year Produced	1971
Addl Info	None
Source	Sumitomo
Melting Practice	BOF
Ingot Position	Concast
Killing Process	Silicon
Process Temperature	930 degC
Process Time	*
Rolling Conditions	89 %
Final Processing	A,R
Final Temperature	*
Final Time	*
Cold Work Strain	*
Aging Temperature	*
Aging Time	*
Location	T

Property Measurements	
Test Type	Nil Ductilty Transition
Position	0/4T
Specimen Type	P-1
Filler Alloy	*
Passes	1
Standard Method	E 208
Standard Year	1969

Orien	Test Temp degC	Break?	NDTT
L	-20	Yes	No
L	-20	Yes	No
L	-20	Yes	No
L	-15	No	Yes
L	-15	No	Yes
L	-15	Yes	Yes
L	-10	No	No
L	-10	No	No
L	-10	No	No

* - not reported

Marine Structural Toughness Data Bank

Material ABS-B

Page 1100.1

Description	
Material Code	004.002.01.1
Material Name	ABS-B
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	50 mm
Composition Type	Actual
Composition Position	Ladle
Lot ID	641661
Reference	004-2

Composition			
C	0.13 %	Mn	1.02 %
P	0.015 %	S	0.011 %
Si	0.25 %	Cr	0.03 %
Ni	0.02 %	Mo	0.005 %
V	*	Cu	0.015 %
Cb	*	Ti	*
B	*	Al	0.03 %
N	*	Other Components	None %

Fabrication History			
Heat Treatment	*	Producer	Australia
Year Produced	1979	Addl Info	None
Source	Australia	Melting Practice	BOF
Ingot Position	Concast	Killing Process	Fully
Process Temperature	870 degC	Process Time	*
Rolling Conditions	81 %	Final Processing	A,R
Final Temperature	*	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Tensile	Position	1/4T
Specimen Type	*	Specimen Thickness	*
Gage Length	200 mm	Loading Rate	*
Tensile Strength Offset	*	Tensile Yield Strength	*
Uniform Elongation	*	Tensile Modulus	*
Standard Method	*	Standard Year	*

Orient	Test Temp degC	UTS MPa	TYP MPa	Elongation %	RA %
L	20	440	282	31	68
T	20	444	258	28	67
T	20	444	288	30	67

* - not reported

Marine Structural Toughness Data Bank

Material ABS-B

Page 1100.2

Description			
Material Code	004.002.01.1	Material Name	ABS-B
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	50 mm	Composition Type	Actual
Composition Position	Ladle	Lot ID	641661
Reference	004-2		

Composition See Page 1100.1

Fabrication History See Page 1100.1

Property Measurements			
Test Type	Charpy V Impact	Position	1/4T
Specimen Type	Full	Lateral Expansion	*
Did Specimen Fracture?	Yes	Did Specimen Split?	*
Standard Method	*	Standard Year	*

Orien	Test Temp degC	CVN Energy Joules	Shear %
L-T ◦	-40	18	15
L-T ◦	-40	44	20
L-T ◦	-40	45	15
L-T ◦	-40	45	15
L-T ◦	-40	73	75
L-T ◦	-40	90	30
L-T ◦	-30	117	40
L-T ◦	-30	29	20
L-T ◦	-30	38	30
L-T ◦	-30	56	25
L-T ◦	-30	62	35
L-T ◦	-30	90	45
L-T ◦	-20	104	55
L-T ◦	-20	113	50
L-T ◦	-20	128	50
L-T ◦	-20	129	60
L-T ◦	-20	68	35
L-T ◦	-20	96	50
L-T ◦	-10	105	50
L-T ◦	-10	110	55
L-T ◦	-10	123	60
L-T ◦	-10	130	65
L-T ◦	-10	134	65
L-T ◦	-10	144	70
L-T ◦	0	104	55
L-T ◦	0	116	60
L-T ◦	0	117	65
L-T ◦	0	133	65
L-T ◦	0	143	80
L-T ◦	0	186	100
L-T ◦	10	126	70
L-T ◦	10	130	75
L-T ◦	10	130	75
L-T ◦	10	136	90

* - not reported

(continued)

Marine Structural Toughness Data Bank

Material ABS-B

Page 1100.3

(continued)

Orien	Test Temp degC	CVN Energy Joules	Shear %
L-T ◊	10	138	70
L-T ◊	10	139	70
L-T ◊	20	143	75
L-T ◊	20	144	95
L-T ◊	20	148	85
L-T ◊	20	154	85
L-T ◊	20	156	90
L-T ◊	20	182	100
L-T ◊	40	155	90
L-T ◊	40	168	100
L-T ◊	40	168	100
L-T ◊	40	170	100
L-T ◊	40	170	100
L-T ◊	40	172	100
T-L △	-40	18	15
T-L △	-40	20	15
T-L △	-40	25	18
T-L △	-40	26	20
T-L △	-40	32	20
T-L △	-40	36	25
T-L △	-30	32	30
T-L △	-30	34	30
T-L △	-30	35	30
T-L △	-30	37	35
T-L △	-30	39	35
T-L △	-30	42	35
T-L △	-20	40	35
T-L △	-20	40	35
T-L △	-20	40	35
T-L △	-20	42	35
T-L △	-20	42	35
T-L △	-20	43	45
T-L △	-10	41	40
T-L △	-10	46	40
T-L △	-10	50	35
T-L △	-10	52	45
T-L △	-10	53	50
T-L △	-10	59	45
T-L △	0	54	60
T-L △	0	55	60
T-L △	0	68	55
T-L △	0	71	55
T-L △	0	71	55
T-L △	0	72	65
T-L △	20	68	65
T-L △	20	70	75
T-L △	20	76	65

* - not reported

(continued)

Marine Structural Toughness Data Bank

Material ABS-B

Page 1100.4

(continued)

Orien	Test Temp degC	CVN Energy Joules	Shear %
T-L ^	20	78	75
T-L ^	20	80	80
T-L ^	20	89	90
T-L ^	40	100	85
T-L ^	40	100	95
T-L ^	40	106	100
T-L ^	40	110	100
T-L ^	40	96	90
T-L ^	40	96	95
T-L ^	60	102	100
T-L ^	60	102	95
T-L ^	60	104	100
T-L ^	60	108	100
T-L ^	60	108	98
T-L ^	60	87	98

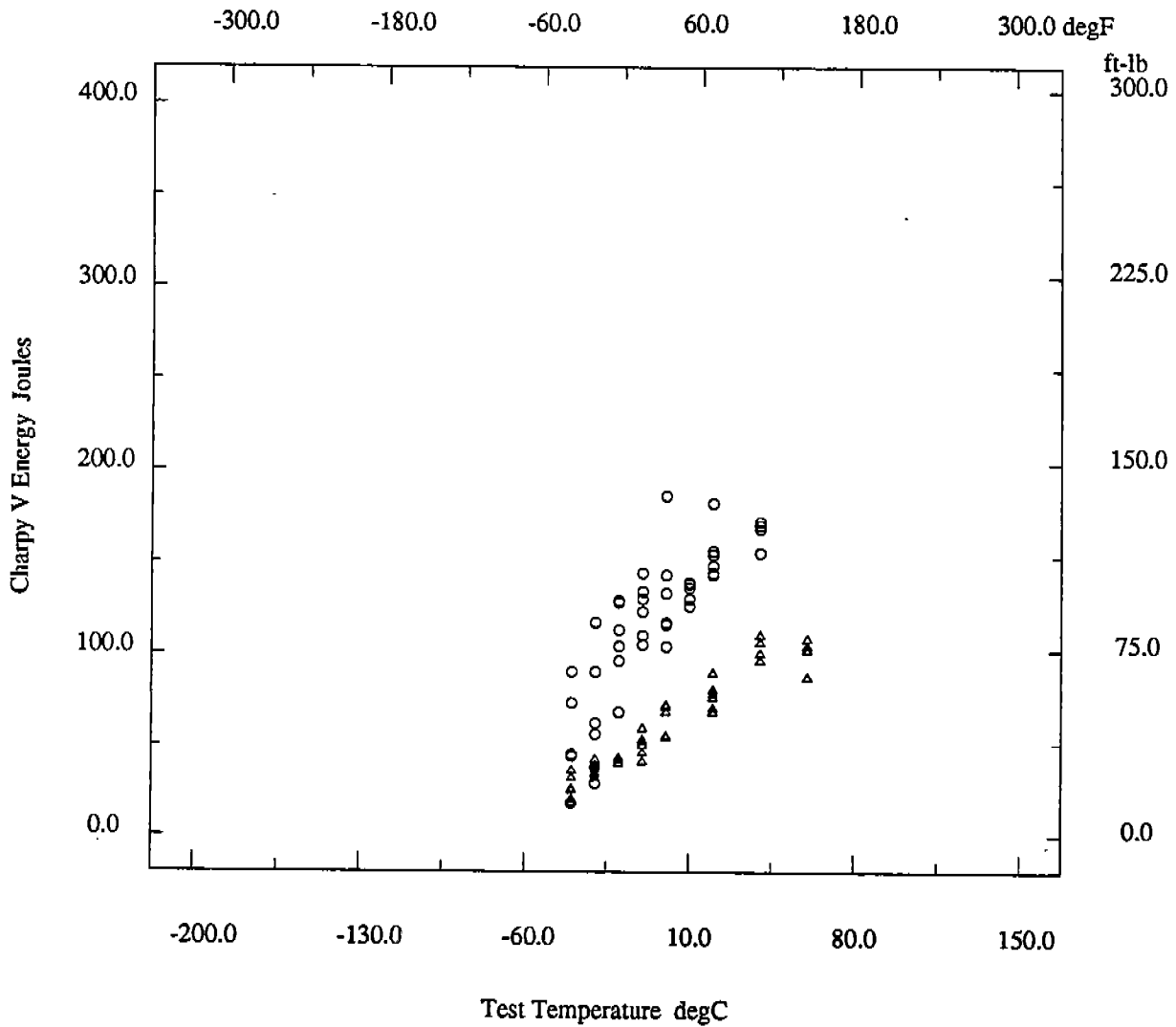
* - not reported

Marine Structural Toughness Data Bank

Material ABS-B

Page 1100.5

Description			
Material Code	004.002.01.1	Material Name	ABS-B
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	50 mm	Composition Type	Actual
Composition Position	Ladle	Lot ID	641661
Reference	004-2		



* - not reported

(51)

Marine Structural Toughness Data Bank

Material ABS-B

Page 1100.6

Description	
Material Code	004.002.01.1
Material Name	ABS-B
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	50 mm
Composition Type	Actual
Composition Position	Ladle
Lot ID	641661
Reference	004-2

Composition See Page 1100.1

Fabrication History See Page 1100.1

Property Measurements	
Test Type	Nil Ductility Transition
Position	0/4T
Specimen Type	P-1
Filler Alloy	Hardex-N
Passes	1
Standard Method	E 208
Standard Year	*

Orien	Test Temp degC	Break?	NDTT
T	-30	Yes	No
T	-25	No	Yes
T	-20	No	No

* - not reported

Marine Structural Toughness Data Bank

Material ABS-EH32

Page 2000.1

Description	
Material Code	032.001.01
Material Name	ABS-EH32
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	METZ/MPC13

Composition			
C	0.16 %	Mn	1.25 %
P	0.015 %	S	0.025 %
Si	0.21 %	Cr	0.11 %
Ni	0.074 %	Mo	0.02 %
V	0.045 %	Cu	0.12 %
Cb	<0.005 %	Ti	*
B	*	Al	0.04 %
N	0.0085 %	Other Components	*

Fabrication History			
Heat Treatment	*	Producer	Armco
Year Produced	*	Addl Info	None
Source	Armco	Melting Practice	*
Ingot Position	*	Killing Process	Fully
Process Temperature	*	Process Time	*
Rolling Conditions	*	Final Processing	N
Final Temperature	*	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Tensile	Position	1/2T
Specimen Type	*	Specimen Thickness	*
Gage Length	2 in	Loading Rate	*
Tensile Strength Offset	*	Tensile Yield Strength	*
Uniform Elongation	*	Tensile Modulus	*
Standard Method	*	Standard Year	*

Orient	Test Temp degF	UTS ksi	TYP ksi	Elongation %	RA %
L	-40	82.0	52.7	38	68
L	-40	82.2	56.0	37	68
L	0	78.6	51.4	38	68
L	0	79.1	51.9	37	68
L	32	75.9	49.8	37	70
L	32	76.8	50.2	38	68
L	75	72.9	49.1	36	69
L	75	74.0	50.7	36	70
T	-40	81.7	54.6	37	65
T	-40	81.9	50.8	38	66
T	0	78.9	53.1	39	65
T	0	79.0	53.0	36	65
T	32	76.2	51.0	36	65
T	32	76.8	51.1	38	66
T	75	72.7	48.8	35	66

* - not reported

(continued)

Marine Structural Toughness Data Bank

Material ABS-EH32

Page 2000.2

(continued)

Orient	Test Temp degF	UTS ksi	TYP ksi	Elongation %	RA %
T	75	73.0	*	35	67

* - not reported

Marine Structural Toughness Data Bank

Material ABS-EH32

Page 2000.3

Description		Material Code 032.001.01		Material Name ABS-EH32		
UNS		*		Other Designation *		
Type Wrought Metal		Form Plate		Composition Type Actual		
Thickness 1 in		Composition Position *		Lot ID *		
Reference METZ/MPC13						
Composition		See Page 2000.1				
Fabrication History		See Page 2000.1				
Property Measurements						
Test Type Fracture Toughness		Position 1/2T		Specimen Thickness 5/8 in		
Specimen Type Double Notch Bend		Loading Type Slow		K _{Ic}		
Crack Length		*		Reason for Invalid		
Loading Rate		*		K _{Jc}		
Valid K _{Ic} ?		*		Maximum J, J _{max}		
J _{Ic}		*		Standard Method		
J _{Icpr}		*				
Tearing Modulus		*				
Standard Year		*				
Orien	Test Temp degF	KQ ksi*in**0.5	CODi mils	CODIc mils	Curve	J _I in-lb/in ²
L-T	-166	70.6	1.2	1.2	Cleavage	257
L-T	-166	79.0	1.8	1.8	Cleavage	372
L-T	-150	73.0	2.0	2.0	Cleavage	379
L-T	-150	77.0	4.0	4.0	Cleavage	847
L-T	-130	71.8	6.8	19.0	Unstable	417
L-T	-130	72.7	2.2	2.2	Cleavage	278
L-T	-112	66.9	5.0	33.0	Unstable	1085
L-T	-112	67.1	11.0	40.0	Unstable	1375
L-T	-40	59.6	16.0	44.0	Maximum	1800
L-T	-40	59.7	15.0	40.0	Maximum	1805
L-T	0	52.6	16.0	37.0	Maximum	1695
L-T	0	56.3	12.0	39.0	Maximum	1475
L-T	32	53.0	15.0	39.0	Maximum	1530
L-T	32	53.7	14.0	30.0	Maximum	1570
L-T	75	49.6	14.0	41.0	Maximum	1465
L-T	75	51.7	16.0	36.0	Maximum	1550

* - not reported



Marine Structural Toughness Data Bank

Material ABS-EH32

Page 2000.4

Description	
Material Code	032.001.01
Material Name	ABS-EH32
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	METZ/MPC13
Composition	See Page 2000.1
Fabrication History	See Page 2000.1
Property Measurements	
Test Type	Charpy V Impact
Position	1/2T
Specimen Type	Full
Did Specimen Fracture?	Yes
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◊	-125	3.0	2.0	0
L-T ◊	-125	7.0	4.0	0
L-T ◊	-100	10.0	8.0	0
L-T ◊	-100	*	13.0	0
L-T ◊	-75	13.5	14.0	2
L-T ◊	-75	19.0	19.0	2
L-T ◊	-50	33.0	31.0	30
L-T ◊	-50	48.0	48.0	80
L-T ◊	-40	35.0	32.0	40
L-T ◊	-40	38.0	37.0	50
L-T ◊	-40	40.0	38.0	60
L-T ◊	-40	*	38.0	60
L-T ◊	0	51.0	47.0	80
L-T ◊	0	67.5	60.0	100
L-T ◊	32	66.0	62.0	100
L-T ◊	32	70.0	64.0	100
L-T ◊	75	71.0	65.0	100
L-T ◊	75	72.0	70.0	100
T-L ▲	-125	5.0	4.0	0
T-L ▲	-125	7.0	5.0	0
T-L ▲	-100	15.0	13.0	0
T-L ▲	-100	15.0	14.0	0
T-L ▲	-75	16.5	16.0	1
T-L ▲	-75	22.0	23.0	5
T-L ▲	-50	28.5	30.0	30
T-L ▲	-50	32.5	33.0	40
T-L ▲	-40	32.0	33.0	50
T-L ▲	-40	32.5	34.0	70
T-L ▲	-40	37.0	37.0	60
T-L ▲	-40	38.5	39.0	60
T-L ▲	0	47.5	50.0	90
T-L ▲	0	*	55.0	100
T-L ▲	32	55.0	56.0	100
T-L ▲	32	57.5	57.0	100

* - not reported

(continued)

Marine Structural Toughness Data Bank

Material ABS-EH32

Page 2000.5

(continued)

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
T-L Δ	75	56.0	60.5	100
T-L Δ	75	58.0	58.5	100

* - not reported

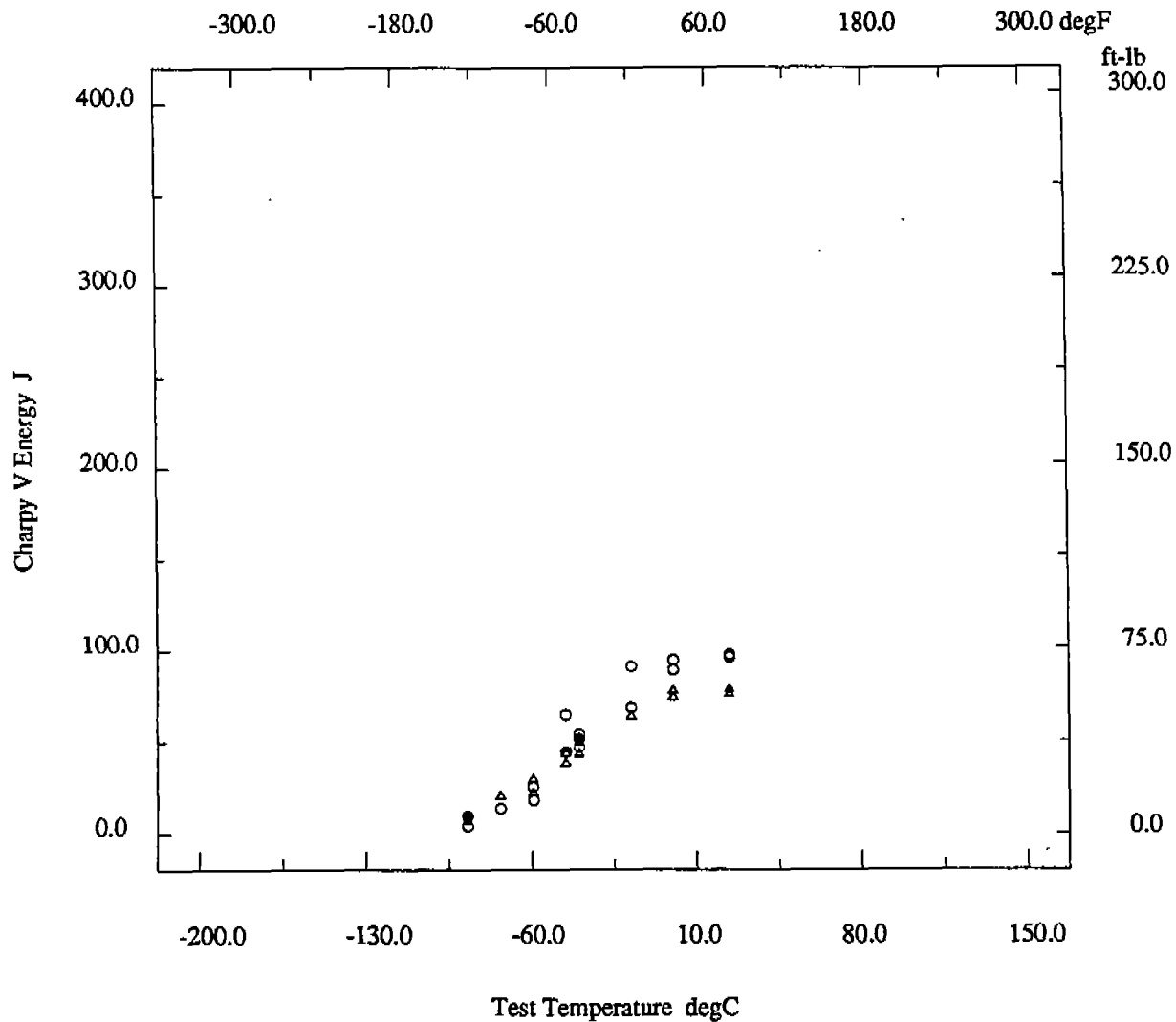


Marine Structural Toughness Data Bank

Material ABS-EH32

Page 2000.6

Description			
Material Code	032.001.01	Material Name	ABS-EH32
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	METZ/MPC13		



* - not reported

Marine Structural Toughness Data Bank

Material ABS-EH32

Page 2000.7

Description	
Material Code	032.001.01
Material Name	ABS-EH32
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	METZ/MPC13

Composition See Page 2000.1

Fabrication History See Page 2000.1

Property Measurements	
Test Type	Nil Ductility Transition
Position	*
Filler Alloy	*
Passes	*
Orientation	*
Standard Method	E 208
Standard Year	*

Spec Type	Test Temp degF	Break?	NDTT
P-3	-50	Yes	Yes
P-1	-40	Yes	Yes

* - not reported



Marine Structural Toughness Data Bank

Material ABS-EH32

Page 2000.8

Description	
Material Code	032.001.01
Material Name	ABS-EH32
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	METZ/MPC13

Composition See Page 2000.1

Fabrication History See Page 2000.1

Property Measurements	
Test Type	Dynamic Tear
Position	1/2T
Specimen Type	Dynamic Tear
Specimen Thickness	5/8 in
Loading Rate	High ksi/sec
Standard Method	E 604
Standard Year	*

Notch Prep	Orien	Test Temp degF	DT Energy ft-lb	Frac Apear %
Pressed	L-T ◦	-80	41	<5
Pressed	L-T ◦	-80	47	<5
Fatigued	L-T ◦	-60	67	10
Fatigued	L-T ◦	-60	75	10
Pressed	L-T ◦	-60	71	<5
Pressed	L-T ◦	-60	72	<5
Fatigued	L-T ◦	-40	82	20
Fatigued	L-T ◦	-40	92	20
Pressed	L-T ◦	-40	91	5
Pressed	L-T ◦	-40	93	5
Pressed	L-T ◦	-20	140	40
Pressed	L-T ◦	-20	168	40
Fatigued	L-T ◦	0	347	50
Fatigued	L-T ◦	0	377	50
Pressed	L-T ◦	0	178	40
Pressed	L-T ◦	0	235	50
Pressed	L-T ◦	15	348	75
Pressed	L-T ◦	15	642	95
Fatigued	L-T ◦	32	655	95
Fatigued	L-T ◦	32	667	100
Pressed	L-T ◦	32	621	100
Pressed	L-T ◦	32	671	100
Pressed	L-T ◦	50	657	100
Pressed	L-T ◦	50	666	100
Fatigued	L-T ◦	72	658	100
Fatigued	L-T ◦	72	673	100
Pressed	L-T ◦	72	600	100
Pressed	L-T ◦	72	643	100
Fatigued	L-T ◦	212	644	100
Pressed	L-T ◦	212	579	100
Pressed	L-T ◦	212	604	100

* - not reported

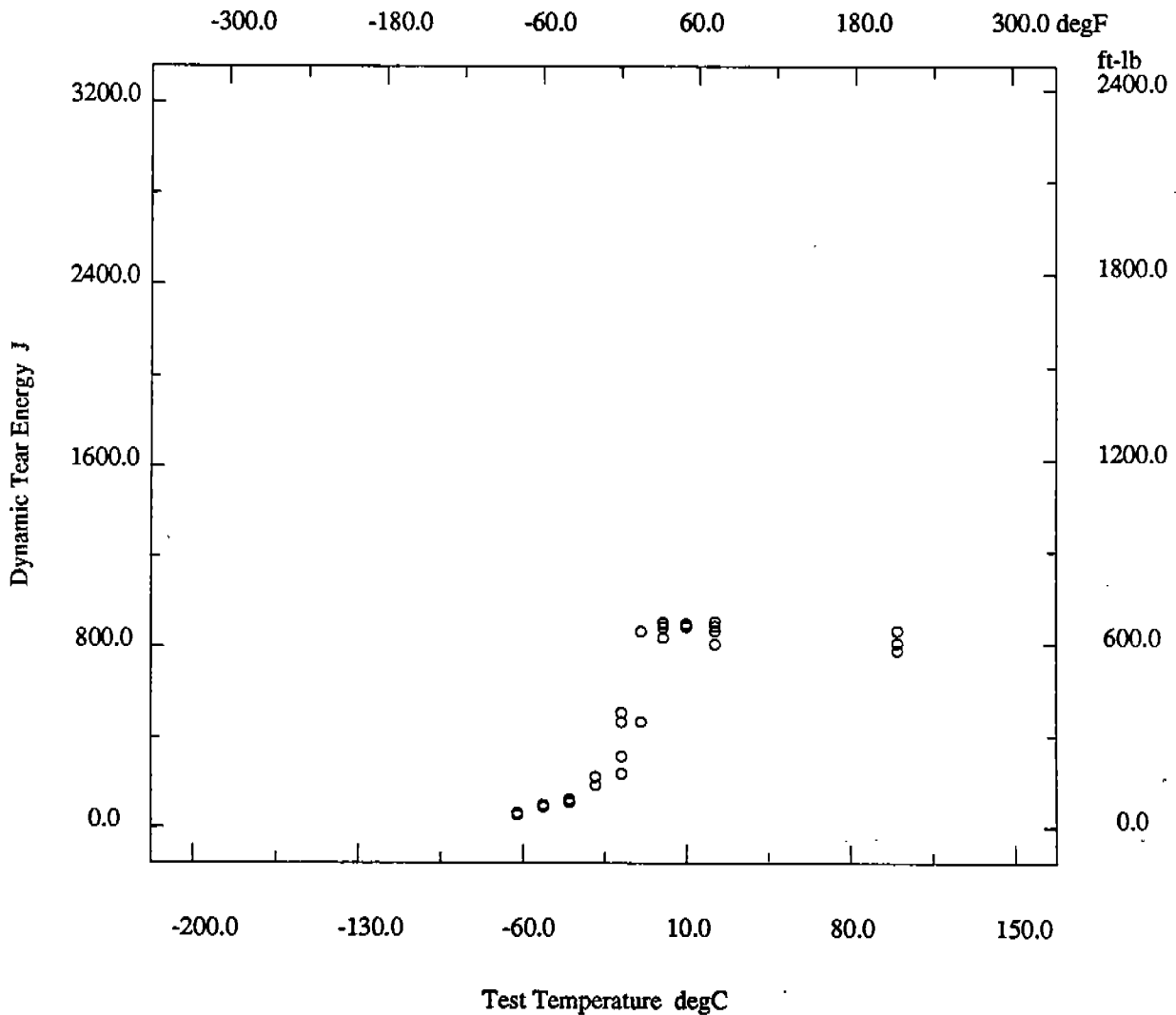
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Marine Structural Toughness Data Bank

Material ABS-EH32

Page 2000.9

Description	
Material Code	032.001.01
Material Name	ABS-EH32
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	METZ/MPC13



* - not reported

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Marine Structural Toughness Data Bank

Material ABS-EH36

Page 2100.1

Description	
Material Code	007.001.01T
Material Name	ABS-EH36
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	12 mm
Composition Type	Actual
Composition Position	Top
Lot ID	KB6479
Reference	007-1

Composition			
C	0.14 %	Mn	1.10 %
P	0.018 %	S	0.015 %
Si	0.19 %	Cr	0.01 %
Ni	0.02 %	Mo	*
V	*	Cu	0.02 %
Cb	*	Ti	*
B	*	Al	0.038 %
N	0.006 %	Other Components	None %

Fabrication History			
Heat Treatment	*	Producer	Kobe
Year Produced	1972	Addl Info	None
Source	Kobe	Melting Practice	BOF
Ingot Position	Top	Killing Process	Fully
Process Temperature	850 degC	Process Time	*
Rolling Conditions	90 %	Final Processing	Q,T
Final Temperature	680 degC	Final Time	2/3 hr
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Tensile	Position	*
Specimen Type	Full	Specimen Thickness	12 mm
Gage Length	*	Loading Rate	*
Tensile Strength Offset	*	Tensile Yield Strength	*
Uniform Elongation	*	Reduction in Area	*
Tensile Modulus	*	Standard Method	*
Standard Year	*		

Orient	Test Temp degC	UTS kgf/mm2	TYP kgf/mm2	Elongation %
L	20	54.1	44.4	24.0
T	20	53.2	44.0	21.5

* - not reported



Marine Structural Toughness Data Bank

Material ABS-EH36

Page 2100.2

Description	
Material Code	007.001.01B
Material Name	ABS-EH36
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	12 mm
Composition Type	Actual
Composition Position	Bottom
Lot ID	KB6479
Reference	007-1

Composition			
C	0.12 %	Mn	1.09 %
P	0.016 %	S	0.014 %
Si	0.18 %	Cr	0.01 %
Ni	0.02 %	Mo	*
V	*	Cu	0.02 %
Cb	*	Ti	*
B	*	Al	0.041 %
N	0.005 %	Other Components	None %

Fabrication History			
Heat Treatment	A,F,A,F,Q,T	Producer	Kobe
Year Produced	1972	Add Info	None
Source	Kobe	Melting Practice	BOF
Ingot Position	Bottom	Killing Process	Fully
Process Temperature	910 degC	Process Time	*
Rolling Conditions	90 %	Final Processing	Q,T
Final Temperature	680 degC	Final Time	2/3 hr
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Tensile	Position	*
Specimen Type	Full	Specimen Thickness	12 mm
Gage Length	*	Loading Rate	*
Tensile Strength Offset	*	Tensile Yield Strength	*
Uniform Elongation	*	Reduction in Area	*
Tensile Modulus	*	Standard Method	*
Standard Year	*		

Orient	Test Temp degC	UTS kgf/mm2	TYP kgf/mm2	Elongation %
L	20	52.6	42.8	26.0
T	20	51.6	43.0	22.0

* - not reported



Marine Structural Toughness Data Bank

Material ABS-EH36

Page 2100.3

Description	
Material Code	007.001.01T
Material Name	ABS-EH36
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	12 mm
Composition Type	Actual
Composition Position	Top
Lot ID	KB6479
Reference	007-1

Composition			
C	0.14 %	Mn	1.10 %
P	0.018 %	S	0.015 %
Si	0.19 %	Cr	0.01 %
Ni	0.02 %	Mo	*
V	*	Cu	0.02 %
Cb	*	Ti	*
B	*	Al	0.038 %
N	0.006 %	Other Components	None %

Fabrication History			
Heat Treatment	*	Producer	Kobe
Year Produced	1972	Addl Info	None
Source	Kobe	Melting Practice	BOF
Ingot Position	Top	Killing Process	Fully
Process Temperature	850 degC	Process Time	*
Rolling Conditions	90 %	Final Processing	Q,T
Final Temperature	680 degC	Final Time	2/3 hr
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Charpy V Impact	Position	1/2T
Specimen Type	Full	Lateral Expansion	*
Did Specimen Fracture?	Assumed	Did Specimen Split?	*
Standard Method	*	Standard Year	*

Orien	Test Temp degC	CVN Energy kgf-m	Shear %
L-T ◦	-100	1.6	10
L-T ◦	-100	1.8	10
L-T ◦	-100	2.2	10
L-T ◦	-80	3.0	25
L-T ◦	-80	3.4	25
L-T ◦	-80	4.7	30
L-T ◦	-60	12.5	60
L-T ◦	-60	13.4	65
L-T ◦	-60	13.9	65
L-T ◦	-40	21.8	100
L-T ◦	-40	23.4	100
L-T ◦	-40	24.0	100
L-T ◦	-40	24.0	100
L-T ◦	-30	23.4	100
L-T ◦	-30	24.0	100
L-T ◦	-30	24.2	100
L-T ◦	-20	23.4	100
L-T ◦	-20	23.4	100

* - not reported

(continued)

Marine Structural Toughness Data Bank

Material ABS-EH36

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(continued)

Orien	Test Temp degC	CVN Energy kgf-m	Shear %
L-T ◊	-20	24.2	100
L-T ◊	-10	24.0	100
L-T ◊	-10	24.0	100
L-T ◊	-10	24.2	100
L-T ◊	0	23.9	100
L-T ◊	0	23.9	100
L-T ◊	0	24.6	100
T-L ▲	-100	0.9	5
T-L ▲	-100	1.1	10
T-L ▲	-100	1.6	10
T-L ▲	-80	2.8	30
T-L ▲	-80	2.9	30
T-L ▲	-80	3.7	40
T-L ▲	-60	5.1	85
T-L ▲	-60	5.5	85
T-L ▲	-60	5.9	80
T-L ▲	-40	10.3	100
T-L ▲	-40	11.2	100
T-L ▲	-40	9.9	100
T-L ▲	-30	11.0	100
T-L ▲	-30	11.5	100
T-L ▲	-30	11.7	100
T-L ▲	-20	11.2	100
T-L ▲	-20	11.5	100
T-L ▲	-20	11.7	100
T-L ▲	-10	10.8	100
T-L ▲	-10	11.2	100
T-L ▲	-10	11.5	100
T-L ▲	0	11.0	100
T-L ▲	0	11.5	100
T-L ▲	0	9.9	100

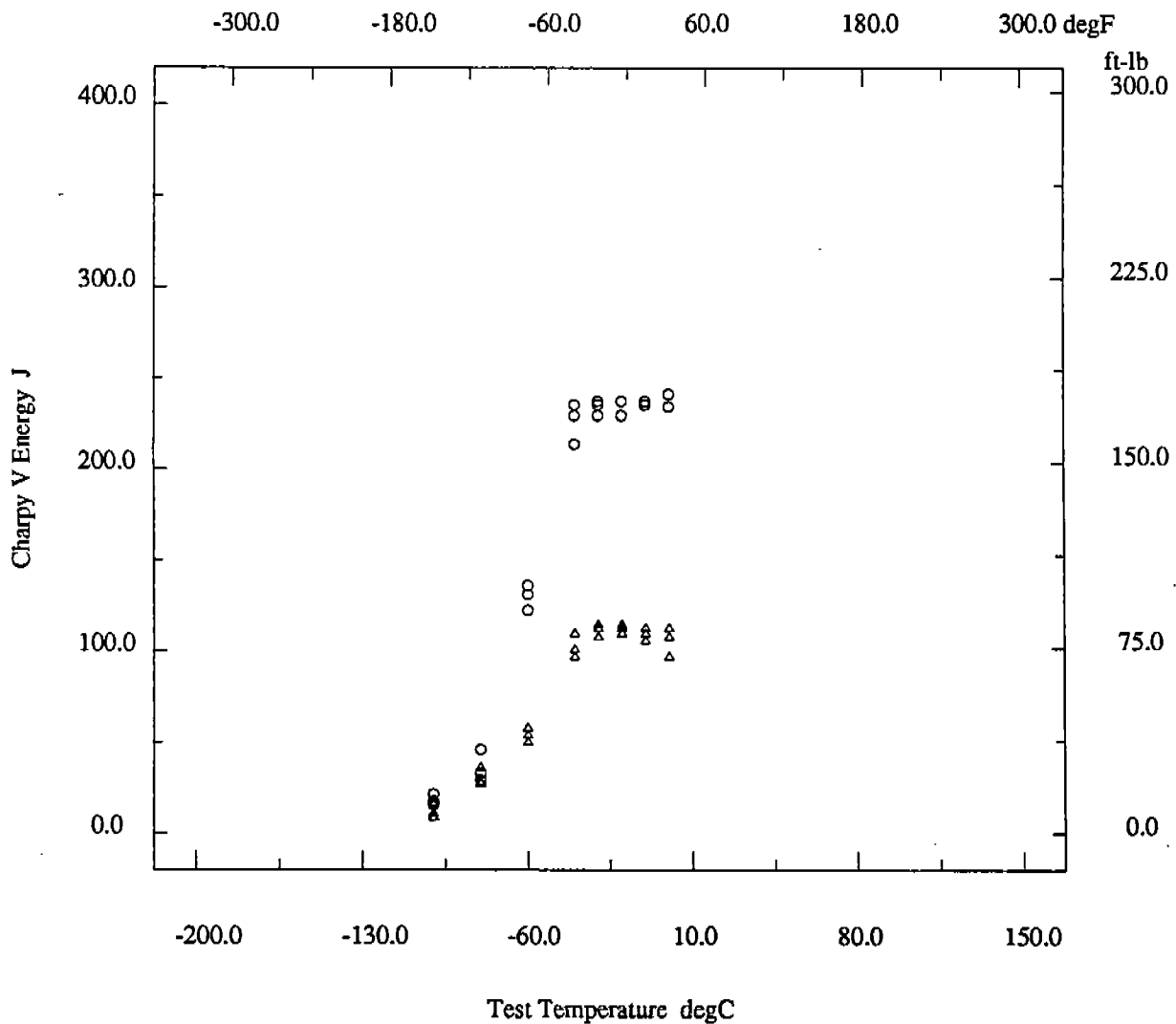
* - not reported

Marine Structural Toughness Data Bank

Material ABS-EH36

Page 2100.5

Description			
Material Code	007.001.01T	Material Name	ABS-EH36
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	12 mm	Composition Type	Actual
Composition Position	Top	Lot ID	KB6479
Reference	007-1		



* - not reported

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Marine Structural Toughness Data Bank

Material ABS-EH36

Page 2100.6

Description	
Material Code	007.001.01B
Material Name	ABS-EH36
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	12 mm
Composition Type	Actual
Composition Position	Bottom
Lot ID	KB6479
Reference	007-1

Composition			
C	0.12 %	Mn	1.09 %
P	0.016 %	S	0.014 %
Si	0.18 %	Cr	0.01 %
Ni	0.02 %	Mo	*
V	*	Cu	0.02 %
Cb	*	Ti	*
B	*	Al	0.041 %
N	0.005 %	Other Components	None %

Fabrication History			
Heat Treatment	A,F,A,F,Q,T	Producer	Kobe
Year Produced	1972	Addl Info	None
Source	Kobe	Melting Practice	BOF
Ingot Position	Bottom	Killing Process	Fully
Process Temperature	910 degC	Process Time	*
Rolling Conditions	90 %	Final Processing	Q,T
Final Temperature	680 degC	Final Time	2/3 hr
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Charpy V Impact	Position	1/4T
Specimen Type	Full	Lateral Expansion	*
Did Specimen Fracture?	Assumed	Did Specimen Split?	*
Standard Method	*	Standard Year	*

Orien	Test Temp degC	CVN Energy kgf-m	Shear %
L-T ◦	-100	1.6	10
L-T ◦	-100	1.6	10
L-T ◦	-100	1.8	10
L-T ◦	-80	5.0	40
L-T ◦	-80	7.3	45
L-T ◦	-80	8.6	45
L-T ◦	-60	13.5	50
L-T ◦	-60	17.3	70
L-T ◦	-60	18.0	75
L-T ◦	-40	23.8	100
L-T ◦	-40	24.6	100
L-T ◦	-40	25.0	100
L-T ◦	-30	28.7	100
L-T ◦	-30	31.9	100
L-T ◦	-30	34.6	100
L-T ◦	-20	29.1	100
L-T ◦	-20	30.3	100

* - not reported

(continued)

Marine Structural Toughness Data Bank

Material ABS-EH36

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(continued)

Orien	Test Temp degC	CVN Energy kgf-m	Shear %
L-T ◊	-20	31.7	100
L-T ◊	-10	30.1	100
L-T ◊	-10	30.1	100
L-T ◊	-10	30.1	100
L-T ◊	0	30.5	100
L-T ◊	0	31.2	100
L-T ◊	0	34.4	100
T-L △	-100	1.6	10
T-L △	-100	1.6	10
T-L △	-100	1.8	10
T-L △	-80	2.8	20
T-L △	-80	2.9	20
T-L △	-80	3.3	20
T-L △	-60	3.8	40
T-L △	-60	4.2	45
T-L △	-60	4.4	45
T-L △	-40	5.9	75
T-L △	-40	6.3	75
T-L △	-40	6.9	75
T-L △	-30	7.2	80
T-L △	-30	7.3	85
T-L △	-30	7.6	85
T-L △	-20	7.8	90
T-L △	-20	8.2	90
T-L △	-20	8.8	95
T-L △	-10	8.4	95
T-L △	-10	9.0	100
T-L △	-10	9.0	100
T-L △	0	9.0	100
T-L △	0	9.7	100
T-L △	0	9.9	100

* - not reported

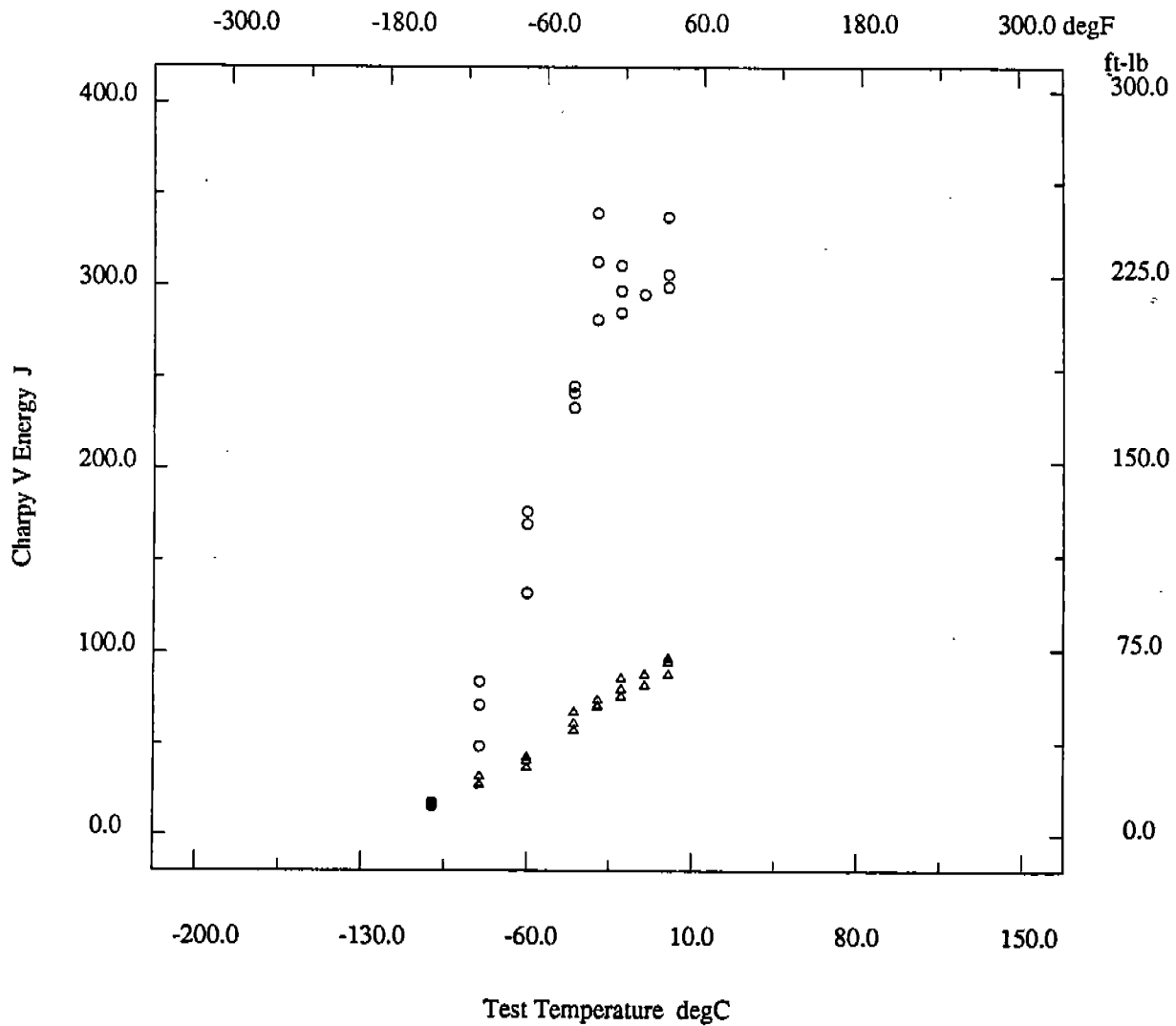


Marine Structural Toughness Data Bank

Material ABS-EH36

Page 2100.8

Description			
Material Code	007.001.01B	Material Name	ABS-EH36
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	12 mm	Composition Type	Actual
Composition Position	Bottom	Lot ID	KB6479
Reference	007-1		



* - not reported



Marine Structural Toughness Data Bank

Material ABS-EH36

Page 2200.1

Description		Material Name	
Material Code	007.002.01T	Material Name	ABS-EH36
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	25 mm	Composition Type	Actual
Composition Position	Top	Lot ID	KB6479
Reference	007-1		

Composition			
C	0.14 %	Mn	1.09 %
P	0.017 %	S	0.015 %
Si	0.19 %	Cr	0.01 %
Ni	0.02 %	Mo	*
V	*	Cu	0.02 %
Cb	*	Ti	*
B	*	Al	0.039 %
N	0.006 %	Other Components	*

Fabrication History			
Heat Treatment	A,F,A,F,Q,T	Producer	Kobe
Year Produced	1972	Addl Info	None
Source	Kobe	Melting Practice	BOF
Ingot Position	Top	Killing Process	Fully
Process Temperature	1055 degC	Process Time	*
Rolling Conditions	85 %	Final Processing	Q,T
Final Temperature	640 degC	Final Time	1 hr
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Tensile	Position	*
Specimen Type	Full	Specimen Thickness	25 mm
Gage Length	*	Loading Rate	*
Tensile Strength Offset	*	Tensile Yield Strength	*
Uniform Elongation	*	Reduction in Area	*
Tensile Modulus	*	Standard Method	*
Standard Year	*		

Orient	Test Temp degC	UTS kgf/mm2	TYP kgf/mm2	Elongation %
L	20	53.7	41.6	26.0
T	20	54.3	41.4	22.0

* - not reported

Marine Structural Toughness Data Bank

Material ABS-EH36

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Description	
Material Code	007.002.01B
Material Name	ABS-EH36
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	25 mm
Composition Type	Actual
Composition Position	Bottom
Lot ID	KB6479
Reference	007-1

Composition			
C	0.12 %	Mn	1.05 %
P	0.015 %	S	0.015 %
Si	0.19 %	Cr	0.01 %
Ni	0.02 %	Mo	*
V	*	Cu	0.02 %
Cb	*	Ti	*
B	*	Al	0.040 %
N	0.005 %	Other Components	*

Fabrication History			
Heat Treatment	*	Producer	Kobe
Year Produced	1972	Addl Info	None
Source	Kobe	Melting Practice	BOF
Ingot Position	Bottom	Killing Process	Fully
Process Temperature	1060 degC	Process Time	*
Rolling Conditions	85 %	Final Processing	Q,T
Final Temperature	640 degC	Final Time	1 hr
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Tensile	Position	*
Specimen Type	Full	Specimen Thickness	25 mm
Gage Length	*	Loading Rate	*
Tensile Strength Offset	*	Tensile Yield Strength	*
Uniform Elongation	*	Reduction in Area	*
Tensile Modulus	*	Standard Method	*
Standard Year	*		

Orient	Test Temp degC	UTS kgf/mm2	TYP kgf/mm2	Elongation %
L	20	52.2	40.4	26.5
T	20	52.1	39.5	28.5

* - not reported

Marine Structural Toughness Data Bank

Material ABS-EH36

Page 2200.3

Description	
Material Code	007.002.01T
Material Name	ABS-EH36
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	25 mm
Composition Type	Actual
Composition Position	Top
Lot ID	KB6479
Reference	007-1

Composition			
C	0.14 %	Mn	1.09 %
P	0.017 %	S	0.015 %
Si	0.19 %	Cr	0.01 %
Ni	0.02 %	Mo	*
V	*	Cu	0.02 %
Cb	*	Ti	*
B	*	Al	0.039 %
N	0.006 %	Other Components	*

Fabrication History			
Heat Treatment	A,F,A,F,Q,T	Producer	Kobe
Year Produced	1972	Addl Info	None
Source	Kobe	Melting Practice	BOF
Ingot Position	Top	Killing Process	Fully
Process Temperature	1055 degC	Process Time	*
Rolling Conditions	85 %	Final Processing	Q,T
Final Temperature	640 degC	Final Time	1 hr
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Charpy V Impact	Position	1/4T
Specimen Type	Full	Lateral Expansion	*
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degC	CVN Energy kgf-m	Shear %	Fracture?
L-T ◦	-100	0.8	5	Yes
L-T ◦	-100	1.4	10	Yes
L-T ◦	-100	1.9	10	Assumed
L-T ◦	-80	2.1	20	Yes
L-T ◦	-80	3.3	20	Yes
L-T ◦	-80	5.2	20	Yes
L-T ◦	-60	3.7	40	Yes
L-T ◦	-60	4.8	45	Yes
L-T ◦	-60	7.2	80	Yes
L-T ◦	-40	21.9	100	Yes
L-T ◦	-40	23.1	100	Yes
L-T ◦	-40	24.1	100	Yes
L-T ◦	-30	21.9	100	Yes
L-T ◦	-30	22.6	100	Yes
L-T ◦	-30	23.6	100	Yes
L-T ◦	-20	22.6	100	Yes
L-T ◦	-20	24.1	100	Yes

* - not reported

(continued)

Marine Structural Toughness Data Bank

Material ABS-EH36

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(continued)

Orien	Test Temp degC	CVN Energy kgf-m	Shear %	Fracture?
L-T ◊	-20	27.9	100	Yes
L-T ◊	-10	20.7	100	Yes
L-T ◊	-10	21.1	100	Yes
L-T ◊	-10	23.3	100	Yes
L-T ◊	0	22.8	100	Yes
L-T ◊	0	24.1	100	Yes
L-T ◊	0	24.8	100	Yes
T-L ▲	-100	0.8	10	Yes
T-L ▲	-100	1.1	10	Yes
T-L ▲	-100	1.6	10	Yes
T-L ▲	-80	1.4	20	Yes
T-L ▲	-80	1.8	20	Yes
T-L ▲	-80	2.1	20	Yes
T-L ▲	-60	2.8	30	Yes
T-L ▲	-60	3.3	30	Yes
T-L ▲	-60	3.7	30	Yes
T-L ▲	-40	7.3	80	Yes
T-L ▲	-40	7.8	70	Yes
T-L ▲	-40	8.2	85	Yes
T-L ▲	-30	6.5	70	Yes
T-L ▲	-30	8.6	95	Yes
T-L ▲	-30	9.7	95	Yes
T-L ▲	-20	7.2	90	Yes
T-L ▲	-20	8.0	95	Yes
T-L ▲	-20	9.0	95	Yes
T-L ▲	-10	9.5	100	Yes
T-L ▲	-10	9.7	100	Yes
T-L ▲	-10	9.7	100	Yes
T-L ▲	0	10.3	100	Yes
T-L ▲	0	10.8	100	Yes
T-L ▲	0	9.5	100	Yes

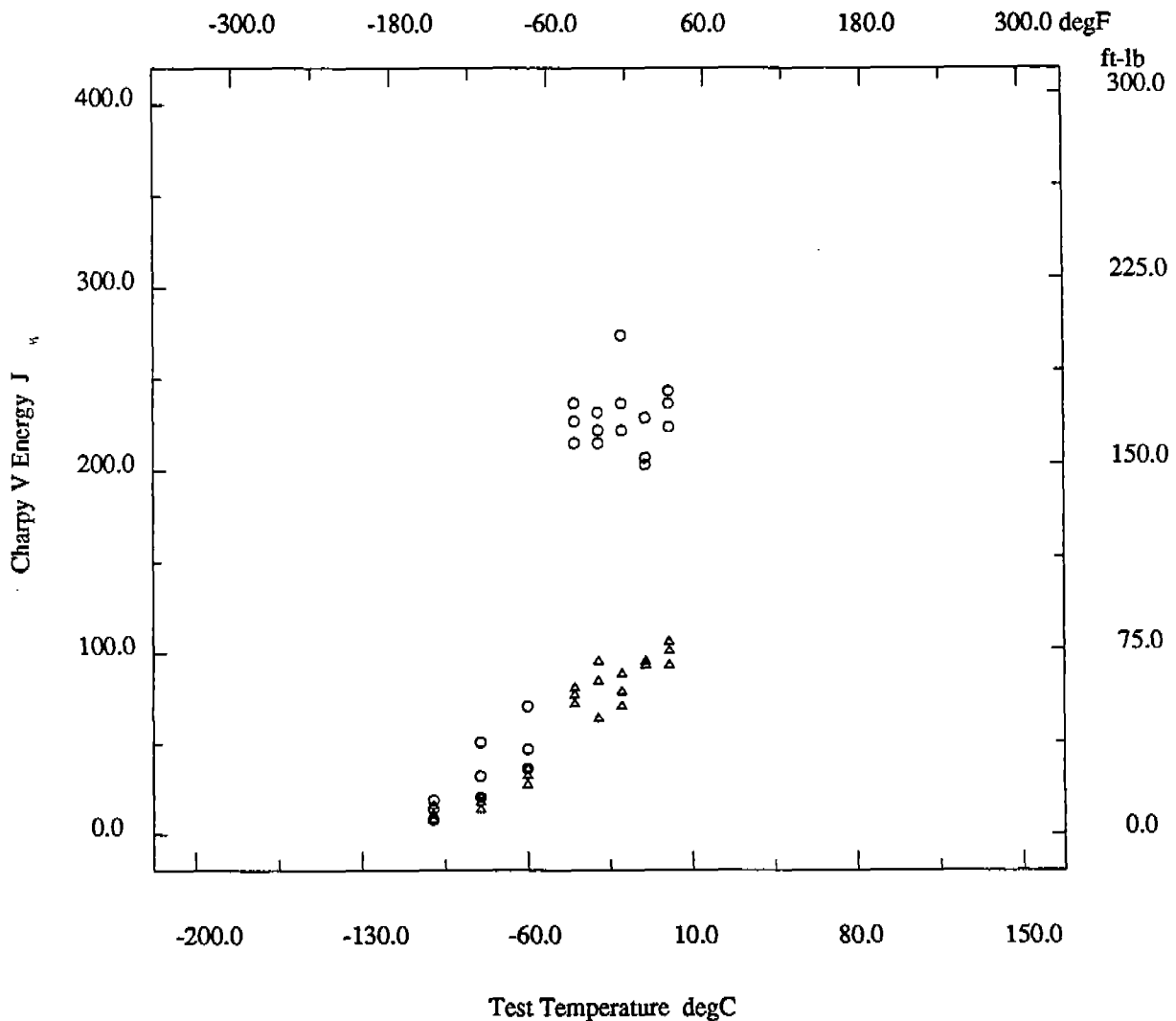
* - not reported

Marine Structural Toughness Data Bank

Material ABS-EH36

Page 2200.5

Description			
Material Code	007.002.01T	Material Name	ABS-EH36
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	25 mm	Composition Type	Actual
Composition Position	Top	Lot ID	KB6479
Reference	007-1		



* - not reported



Marine Structural Toughness Data Bank

Material ABS-EH36

Page 2200.6

Description	
Material Code	007.002.01B
Material Name	ABS-EH36
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	25 mm
Composition Type	Actual
Composition Position	Bottom
Lot ID	KB6479
Reference	007-1

Composition			
C	0.12 %	Mn	1.05 %
P	0.015 %	S	0.015 %
Si	0.19 %	Cr	0.01 %
Ni	0.02 %	Mo	*
V	*	Cu	0.02 %
Cb	*	Ti	*
B	*	Al	0.040 %
N	0.005 %	Other Components	*

Fabrication History			
Heat Treatment	*	Producer	Kobe
Year Produced	1972	Addl Info	None
Source	Kobe	Melting Practice	BOF
Ingot Position	Bottom	Killing Process	Fully
Process Temperature	1060 degC	Process Time	*
Rolling Conditions	85 %	Final Processing	Q,T
Final Temperature	640 degC	Final Time	1 hr
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Charpy V Impact	Position	1/4T
Specimen Type	Full	Lateral Expansion	*
Did Specimen Fracture?	Yes	Did Specimen Split?	*
Standard Method	*	Standard Year	*

Orien	Test Temp degC	CVN Energy kgf-m	Shear %
L-T ◦	-100	0.8	10
L-T ◦	-100	1.9	10
L-T ◦	-100	2.6	10
L-T ◦	-80	2.1	15
L-T ◦	-80	2.4	15
L-T ◦	-80	3.8	15
L-T ◦	-60	14.0	70
L-T ◦	-60	19.9	75
L-T ◦	-60	20.2	80
L-T ◦	-40	29.1	100
L-T ◦	-40	30.7	100
L-T ◦	-40	34.8	100
L-T ◦	-30	28.7	100
L-T ◦	-30	32.4	100
L-T ◦	-30	32.6	100
L-T ◦	-20	33.0	100
L-T ◦	-20	33.7	100

* - not reported

(continued)

Marine Structural Toughness Data Bank

Material ABS-EH36

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(continued)

Orien	Test Temp degC	CVN Energy kgf-m	Shear %
L-T ◊	-20	33.9	100
L-T ◊	-10	33.2	100
L-T ◊	-10	35.0	100
L-T ◊	-10	35.7	100
L-T ◊	0	32.1	100
L-T ◊	0	32.6	100
L-T ◊	0	35.2	100
T-L ▲	-100	0.6	5
T-L ▲	-100	1.1	5
T-L ▲	-100	1.9	5
T-L ▲	-80	2.1	15
T-L ▲	-80	2.1	15
T-L ▲	-80	2.6	15
T-L ▲	-60	3.1	35
T-L ▲	-60	3.5	40
T-L ▲	-60	4.6	40
T-L ▲	-40	5.6	70
T-L ▲	-40	5.6	70
T-L ▲	-40	7.2	75
T-L ▲	-30	6.9	75
T-L ▲	-30	8.0	80
T-L ▲	-30	8.8	80
T-L ▲	-20	7.6	90
T-L ▲	-20	9.5	95
T-L ▲	-20	9.7	100
T-L ▲	-10	11.5	100
T-L ▲	-10	9.5	95
T-L ▲	-10	9.9	95
T-L ▲	0	10.3	100
T-L ▲	0	10.3	100
T-L ▲	0	10.8	100

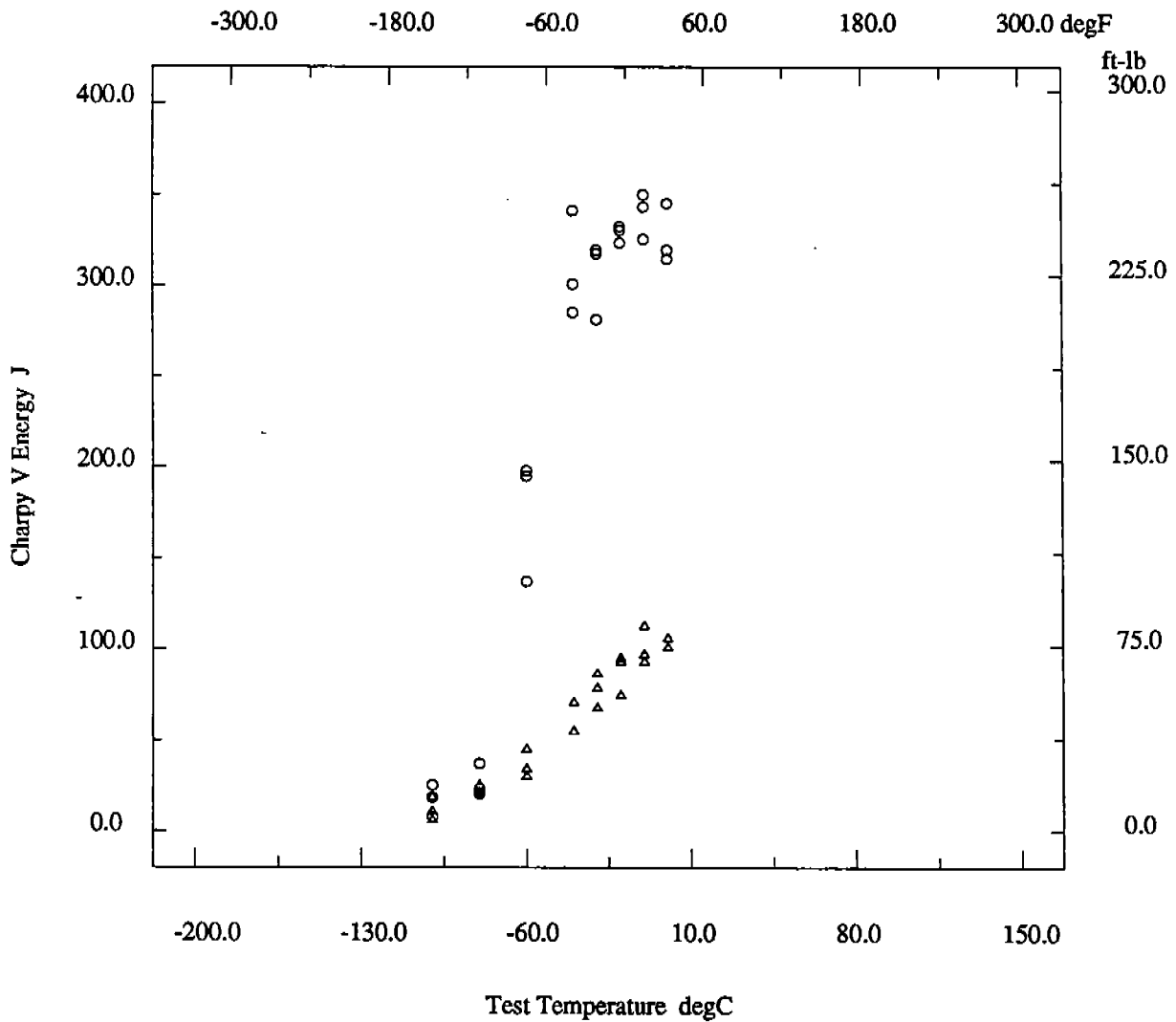
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Marine Structural Toughness Data Bank

Material ABS-EH36

Page 2200.8

Description			
Material Code	007.002.01B	Material Name	ABS-EH36
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	25 mm	Composition Type	Actual
Composition Position	Bottom	Lot ID	KB6479
Reference	007-1		



* - not reported

TS

Marine Structural Toughness Data Bank

Material A36

Page 3100.1

Description						
Material Code	009.002.010A	Material Name	A36			
UNS	*	Other Designation	*			
Type	Wrought Metal	Form	Plate			
Thickness	1 in	Composition Type	Actual			
Composition Position	*	Lot ID	*			
Reference	KONKUL-1					
Composition						
C	0.21 %	Mn	1.17 %			
P	0.011 %	S	0.022 %			
Si	0.04 %	Cr	0.05 %			
Ni	0.03 %	Mo	0.01 %			
V	<0.002 %	Cu	0.04 %			
Cb	<0.005 %	Ti	*			
B	*	Al	<0.002 %			
N	0.003 %	Other Components	None %			
Fabrication History						
Heat Treatment	*	Producer	US Steel			
Year Produced	*	Addl Info	*			
Source	US Steel	Melting Practice	*			
Ingot Position	*	Killing Process	*			
Process Temperature	*	Process Time	*			
Rolling Conditions	*	Final Processing	A,R			
Final Temperature	*	Final Time	*			
Cold Work Strain	*	Aging Temperature	*			
Aging Time	*	Location	*			
Property Measurements						
Test Type	Tensile	Position	1/4T			
Specimen Type	Cylindrical	Specimen Thickness	0.357 in			
Gage Length	1.4 in	Loading Rate	*			
Tensile Strength Offset	0.2 %	Uniform Elongation	*			
Tensile Modulus	*	Standard Method	*			
Standard Year	*					
Orient	Test Temp degF	UTS ksi	TYS ksi	TYP ksi	Elongation %	RA %
*	Room	71.1	38.9	*	34.8	70.8

* - not reported



Marine Structural Toughness Data Bank

Material A36

Page 3100.2

Description	
Material Code	009.002.02AS1
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 3100.1

Fabrication History See Page 3100.1

Weld	
Weld Code	009.002.02AS1
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	Downhand IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	350 degF
Passes	15
Filler Specification	E7018
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	1100 degF
Post-Weld Heat Time	1 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-50	10	12	10
L-T ◦	-50	15	13	10
L-T ◦	-25	11	12	20
L-T ◦	-25	93	90	45
L-T ◦	0	106	88	70
L-T ◦	0	43	38	70
L-T ◦	0	8	12	15
L-T ◦	25	118	78	85
L-T ◦	25	35	32	60
L-T ◦	25	97	76	50
L-T ◦	50	123	87	85
L-T ◦	50	96	78	75

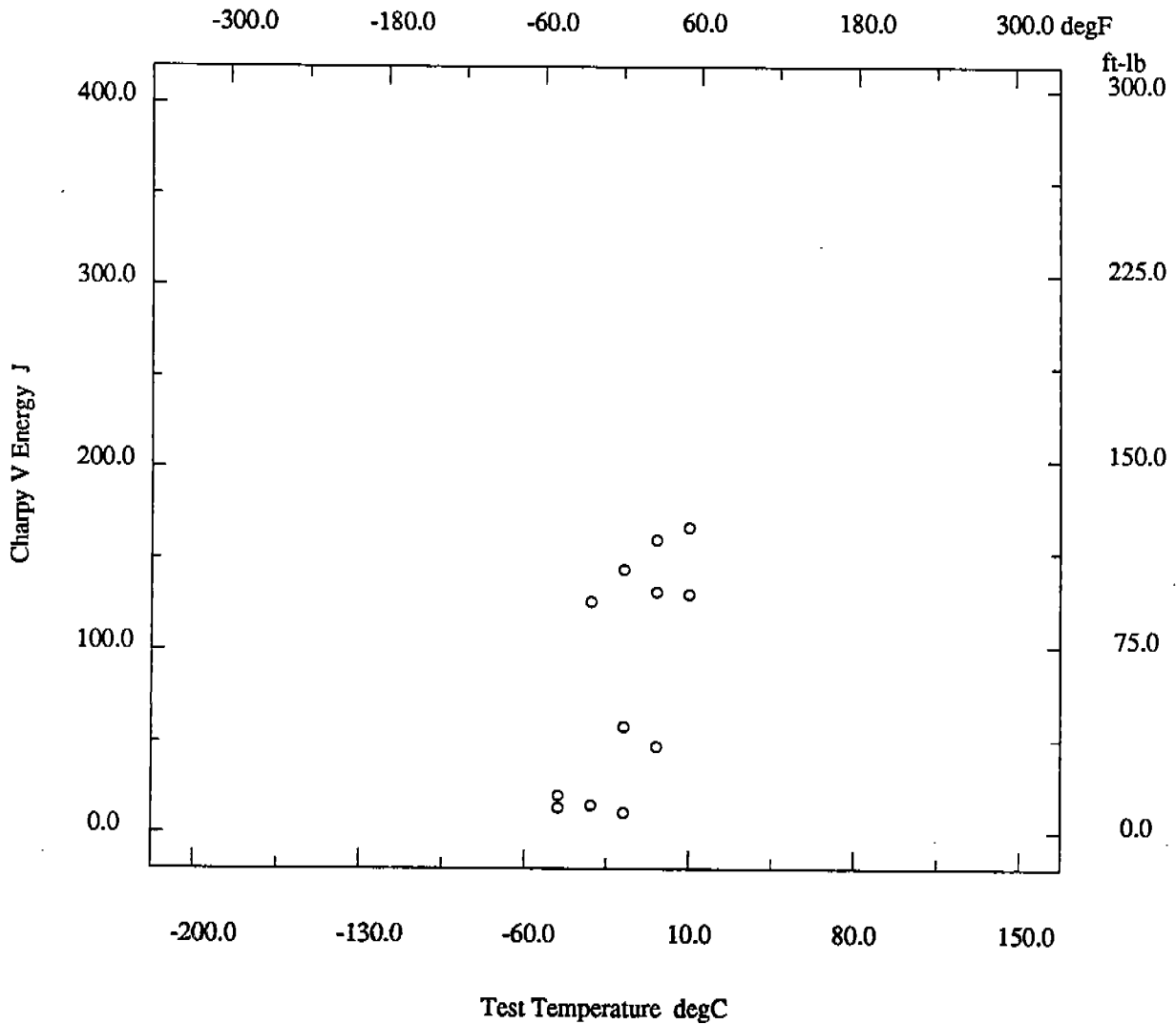
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Marine Structural Toughness Data Bank

Material A36

Page 3100.3

Description	
Material Code	009.002.02AS1
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1



* - not reported



Marine Structural Toughness Data Bank

Material A36

Page 3100.4

Description	
Material Code	009.002.02AS2
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 3100.1

Fabrication History See Page 3100.1

Weld	
Weld Code	009.002.02AS2
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	Downhand IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	350 degF
Passes	15
Filler Specification	E7018
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	1100 degF
Post-Weld Heat Time	5 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T °	-50	5	7	5
L-T °	-50	7	9	10
L-T °	-25	15	15	35
L-T °	-25	59	48	30
L-T °	-25	96	79	70
L-T °	0	25	22	45
L-T °	0	65	51	70
L-T °	0	86	79	75
L-T °	50	110	93	100
L-T °	50	94	80	80

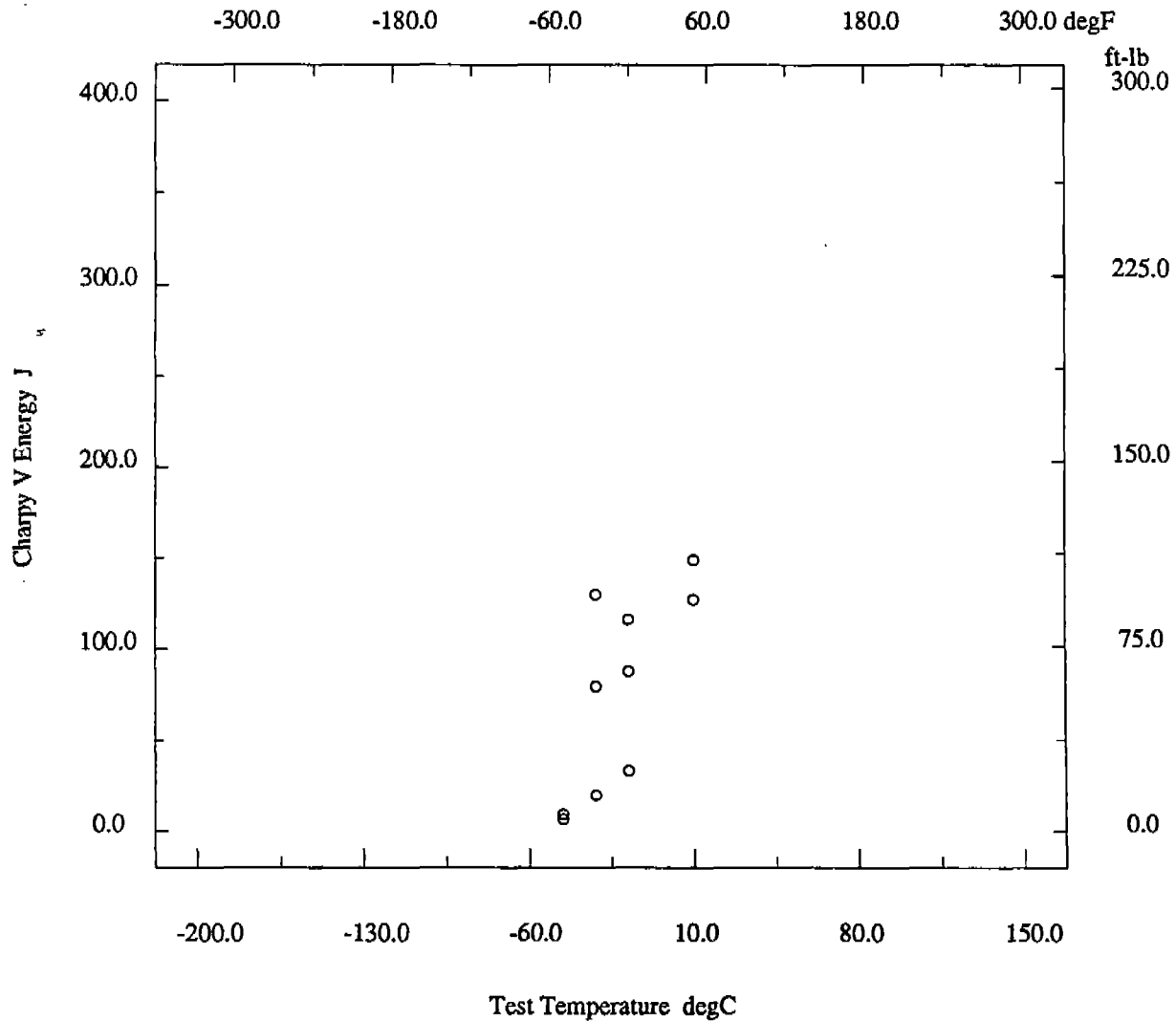
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Marine Structural Toughness Data Bank

Material A36

Page 3100.5

Description			
Material Code	009.002.02AS2	Material Name	A36
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

(2)

Marine Structural Toughness Data Bank

Material A36

Page 3100.6

Description	
Material Code	009.002.02AS3
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 3100.1

Fabrication History See Page 3100.1

Weld	
Weld Code	009.002.02AS3
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	Downhand IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	350 degF
Passes	15
Filler Specification	E7018
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	1200 degF
Post-Weld Heat Time	1 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-50	11	12	15
L-T ◦	-50	5	5	10
L-T ◦	-25	18	20	75
L-T ◦	-25	7	8	20
L-T ◦	-25	81	61	75
L-T ◦	0	77	61	65
L-T ◦	0	80	65	75
L-T ◦	50	71	54	75
L-T ◦	50	90	74	50
L-T ◦	75	121	86	100
L-T ◦	75	125	89	90

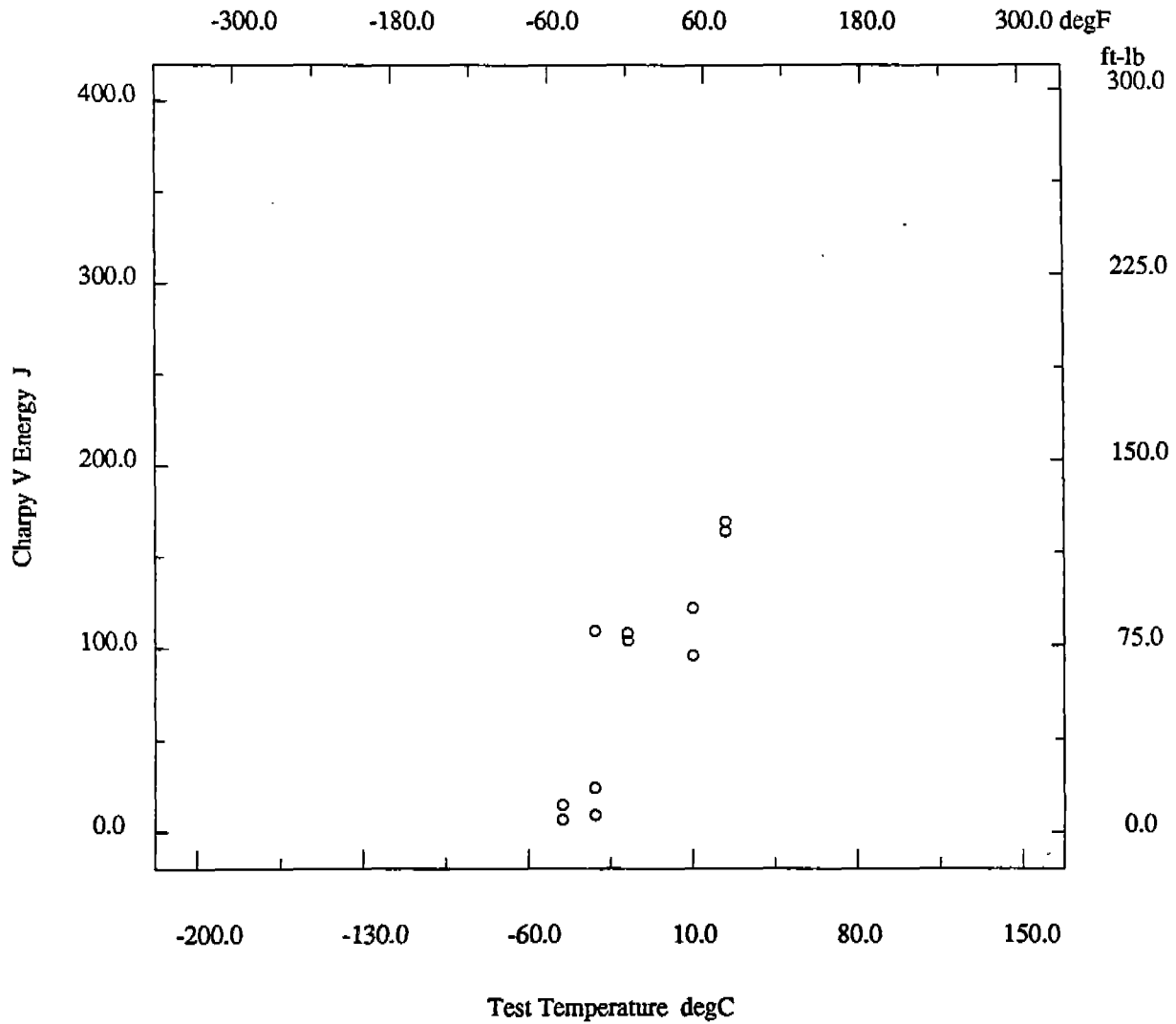
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Marine Structural Toughness Data Bank

Material A36

Page 3100.7

Description			
Material Code	009.002.02AS3	Material Name	A36
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported



Marine Structural Toughness Data Bank

Material A36

Page 3100.8

Description	
Material Code	009.002.02AA
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1
Composition	See Page 3100.1
Fabrication History	See Page 3100.1
Weld	
Weld Code	009.002.02AA
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	Downhand IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	350 degF
Passes	15
Filler Specification	E7018
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	*
Post-Weld Heat Time	*
Flux Type	*
Flux Name	*
Weld Composition Reported?	No
Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-50	5	1	5
L-T ◦	-50	9	9	10
L-T ◦	-25	25	15	30
L-T ◦	-25	42	32	40
L-T ◦	-25	7	6	15
L-T ◦	0	15	19	20
L-T ◦	0	19	17	45
L-T ◦	0	21	25	25
L-T ◦	25	102	67	75
L-T ◦	25	33	30	70
L-T ◦	25	54	40	35
L-T ◦	50	109	78	90
L-T ◦	50	111	72	90

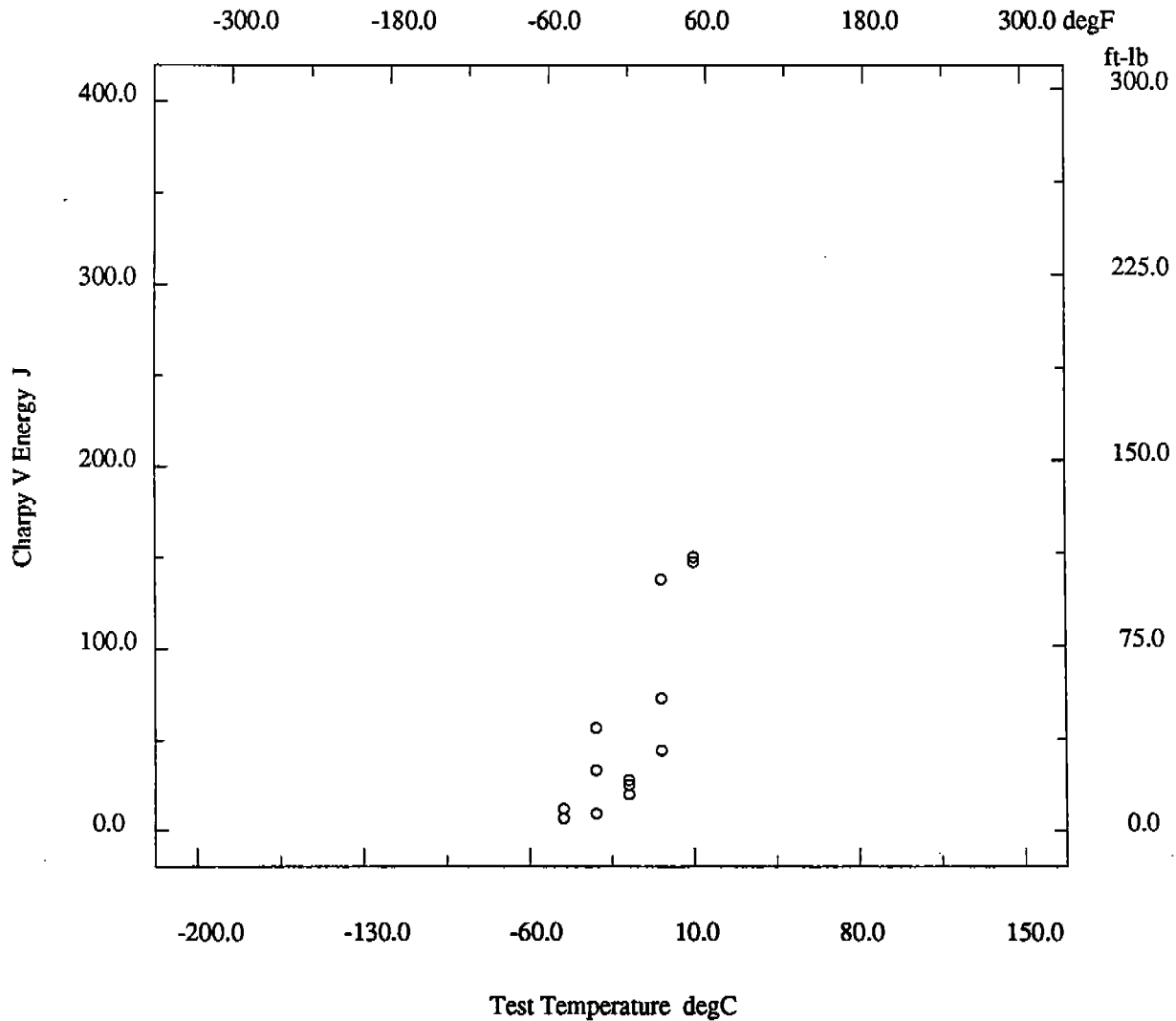
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Marine Structural Toughness Data Bank

Material A36

Page 3100.9

Description				
Material Code	009.002.02AA	Material Name	A36	
UNS	*	Other Designation	*	
Type	Welded Joint	Form	Plate	
Thickness	1 in	Composition Type	Actual	
Composition Position	*	Lot ID	*	
Reference	KONKUL-1			



* - not reported



Marine Structural Toughness Data Bank

Material A36

Page 3100.10

Description	
Material Code	009.002.02AS4
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1
Composition	See Page 3100.1
Fabrication History	See Page 3100.1
Weld	
Weld Code	009.002.02AS4
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	Downhand IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	350 degF
Passes	15
Filler Specification	E7018
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	1200 degF
Post-Weld Heat Time	5 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No
Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-50	11	10	15
L-T ◦	-50	17	14	10
L-T ◦	-25	28	26	30
L-T ◦	-25	8	10	20
L-T ◦	-25	8	6	20
L-T ◦	0	118	96	55
L-T ◦	0	11	16	15
L-T ◦	0	21	22	45
L-T ◦	25	115	75	85
L-T ◦	25	83	69	75
L-T ◦	50	123	90	80
L-T ◦	50	61	52	85

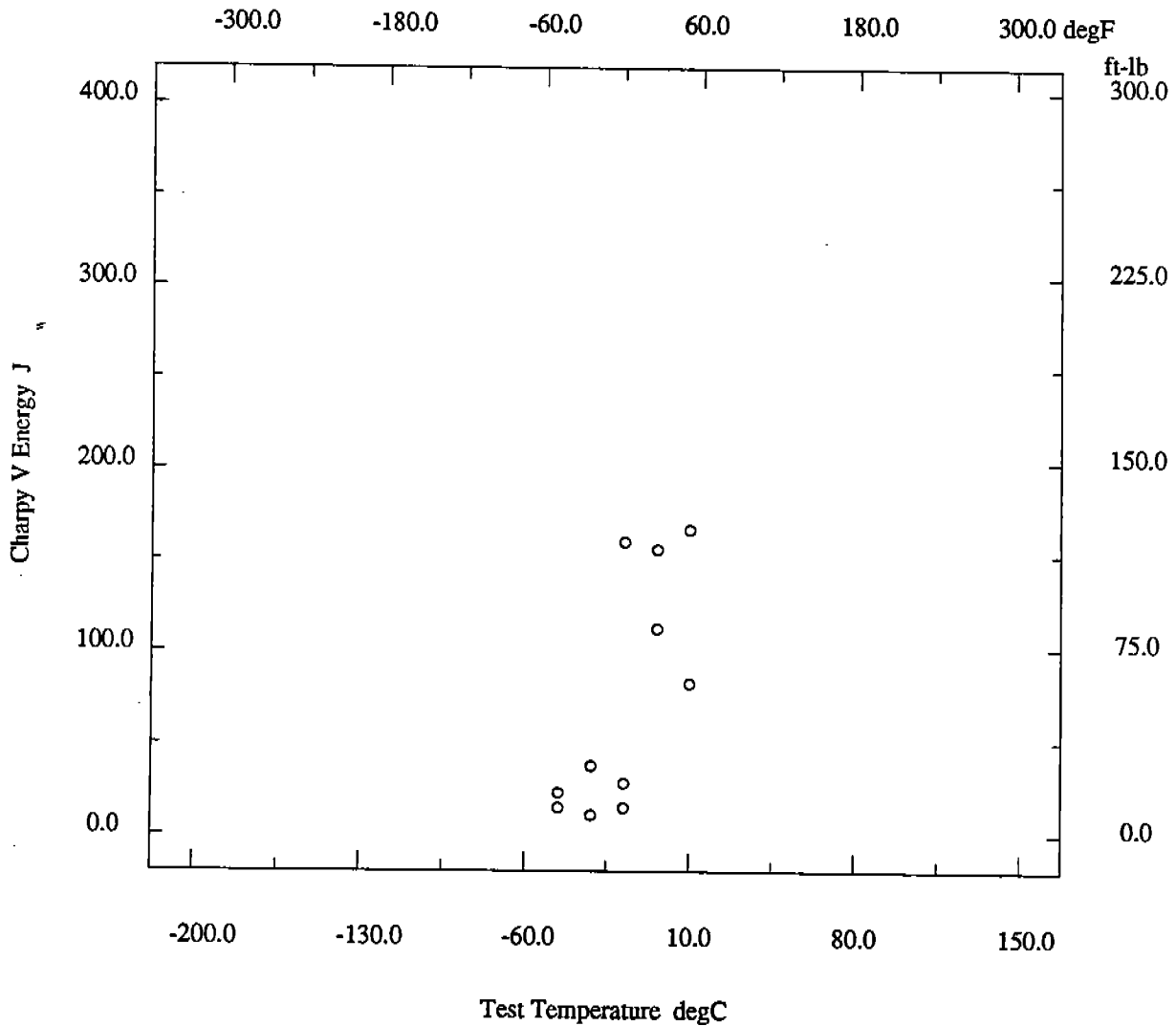
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Marine Structural Toughness Data Bank

Material A36

Page 3100.11

Description	
Material Code	009.002.02AS4
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1



* - not reported

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Marine Structural Toughness Data Bank

Material A36

Page 3200.1

Description	
Material Code	009.002.09BW
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition			
C	0.21 %	Mn	1.17 %
P	0.011 %	S	0.022 %
Si	0.04 %	Cr	0.05 %
Ni	0.03 %	Mo	0.01 %
V	<0.002 %	Cu	0.04 %
Cb	<0.005 %	Ti	*
B	*	Al	<0.002 %
N	0.003 %	Other Components	None %

Fabrication History			
Heat Treatment	*	Producer	US Steel
Year Produced	*	Addl Info	*
Source	US Steel	Melting Practice	*
Ingot Position	*	Killing Process	*
Process Temperature	*	Process Time	*
Rolling Conditions	*	Final Processing	A,R
Final Temperature	*	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Weld			
Weld Code	009.002.09BW	Weld Type	SAW
Base Metal Thickness	1 in	Welding Position	Downhand IG
Preheat Temperature	50 degF	Metal Gap	5/16 in
Interpass Temperature	350 degF	Passes	7
Filler Specification	F72-EM12K	Filler Name	*
Filler Carbon Content	*	Filler Metal Size	*
Shielding Gas	*	Voltage	*
Amperage	*	Polarity	*
Travel Speed	*	Heat Input/Pass	74 KJ/in
Joint Preparation	V Groove	Number of Sides	1
Location wrt Weld	11mm in HAZ	Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		

* - not reported

(continued)



Marine Structural Toughness Data Bank

Material A36

Page 3200.2

(continued)

Property Measurements			
Test Type	Charpy V Impact	Position	3/4T
Specimen Type	Full	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-75	5	4	10
L-T ◦	-75	6	6	15
L-T ◦	-50	23	21	35
L-T ◦	-50	46	34	30
L-T ◦	-25	20	24	35
L-T ◦	-25	57	42	45
L-T ◦	0	75	58	65
L-T ◦	0	76	60	75
L-T ◦	50	105	79	90
L-T ◦	50	109	82	95

* - not reported

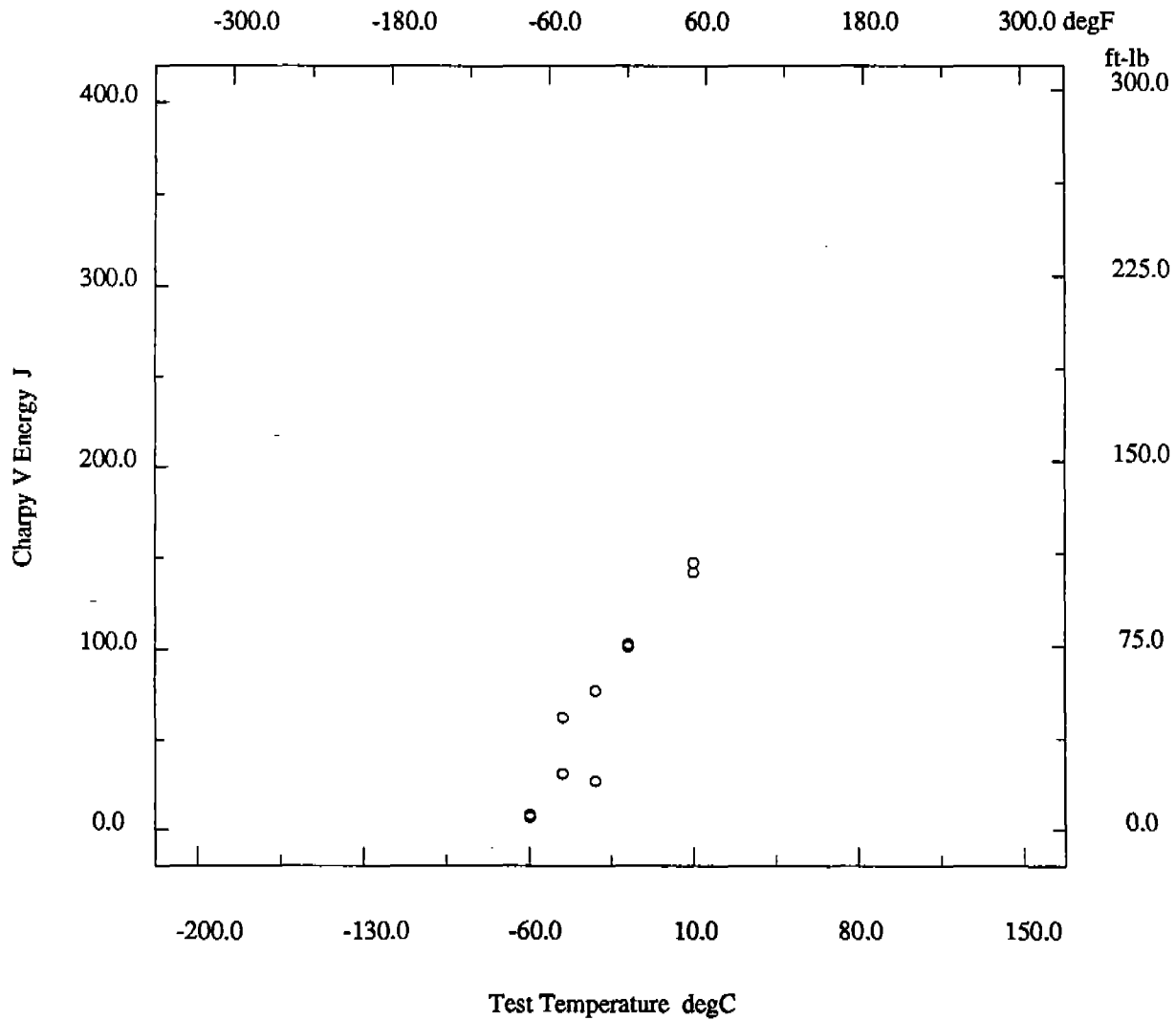
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Marine Structural Toughness Data Bank

Material A36

Page 3200.3

Description	
Material Code	009.002.09BW
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1



* - not reported

Marine Structural Toughness Data Bank

Material A36

Page 3200.4

Description	
Material Code	009.002.02BW
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 3200.1

Fabrication History See Page 3200.1

Weld	
Weld Code	009.002.02BW
Weld Type	SAW
Base Metal Thickness	1 in
Welding Position	Downhand IG
Preheat Temperature	50 degF
Metal Gap	5/16 in
Interpass Temperature	350 degF
Passes	7
Filler Specification	F72-EM12K
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	74 KJ/in
Joint Preparation	V Groove
Number of Sides	1
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	*
Post-Weld Heat Time	*
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T °	-100	12	8	10
L-T °	-100	5	4	10
L-T °	-75	20	13	25
L-T °	-75	35	25	20
L-T °	-50	23	22	35
L-T °	-50	27	25	30
L-T °	-25	55	45	30
L-T °	-25	63	49	35
L-T °	0	105	78	80
L-T °	0	70	62	70
L-T °	50	121	85	95
L-T °	50	125	88	95

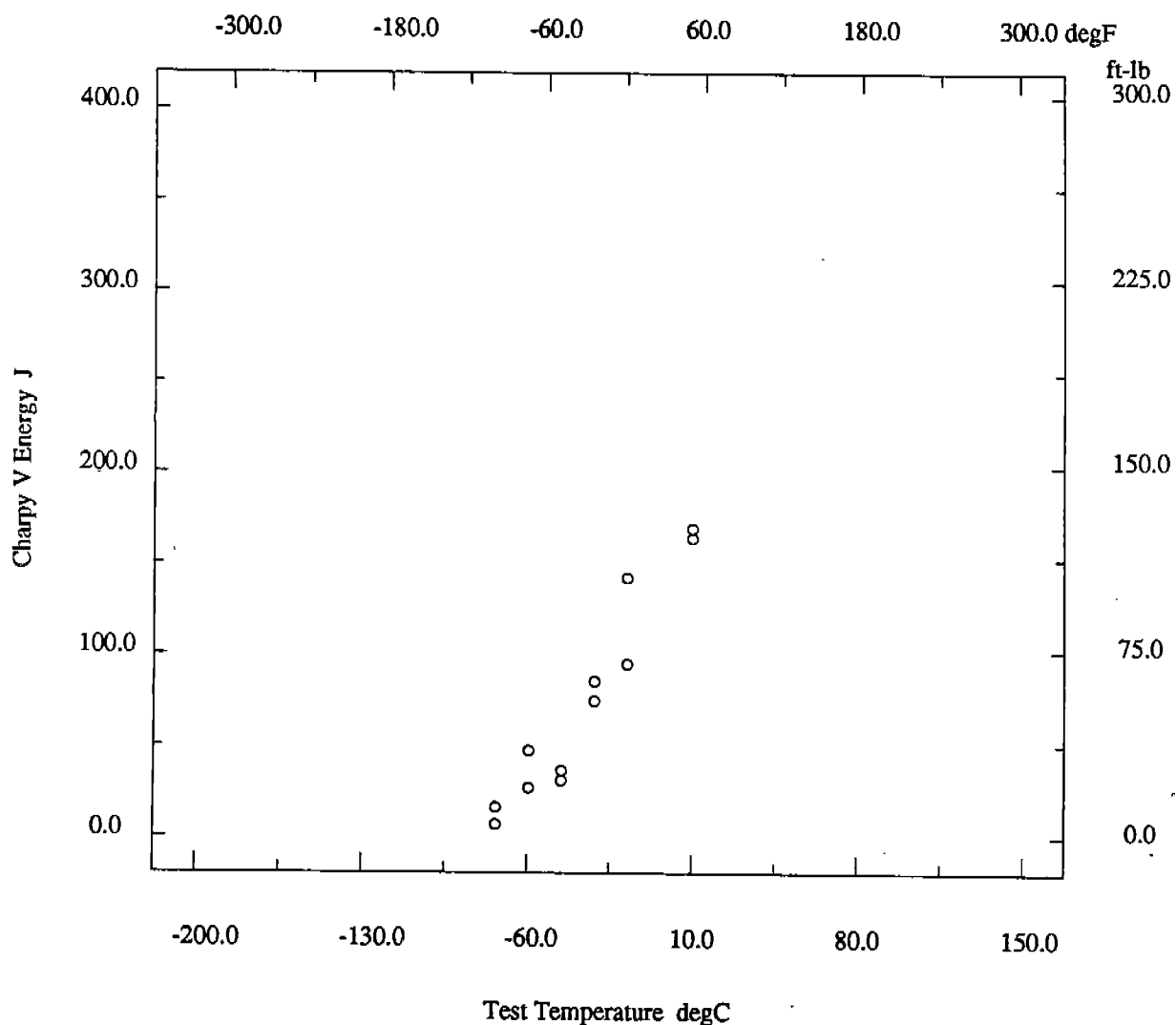
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Marine Structural Toughness Data Bank

Material A36

Page 3200.5

Description			
Material Code	009.002.02BW	Material Name	A36
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

Marine Structural Toughness Data Bank

Material A36

Page 3200.6

Description	
Material Code	009.002.02BS1
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 3200.1

Fabrication History See Page 3200.1

Weld	
Weld Code	009.002.02BS1
Weld Type	SAW
Base Metal Thickness	1 in
Welding Position	Downhand IG
Preheat Temperature	50 degF
Metal Gap	5/16 in
Interpass Temperature	350 degF
Passes	7
Filler Specification	F72-EM12K
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	74 KJ/in
Joint Preparation	V Groove
Number of Sides	1
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	1100 degF
Post-Weld Heat Time	1 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-100	2	1	5
L-T ◦	-100	3	1	5
L-T ◦	-75	21	11	10
L-T ◦	-75	63	53	40
L-T ◦	-75	8	4	5
L-T ◦	-50	10	11	20
L-T ◦	-50	45	40	35
L-T ◦	-50	5	6	10
L-T ◦	-25	21	14	25
L-T ◦	-25	86	60	60
L-T ◦	0	108	77	90
L-T ◦	0	115	88	95
L-T ◦	50	109	73	100
L-T ◦	50	139	87	100

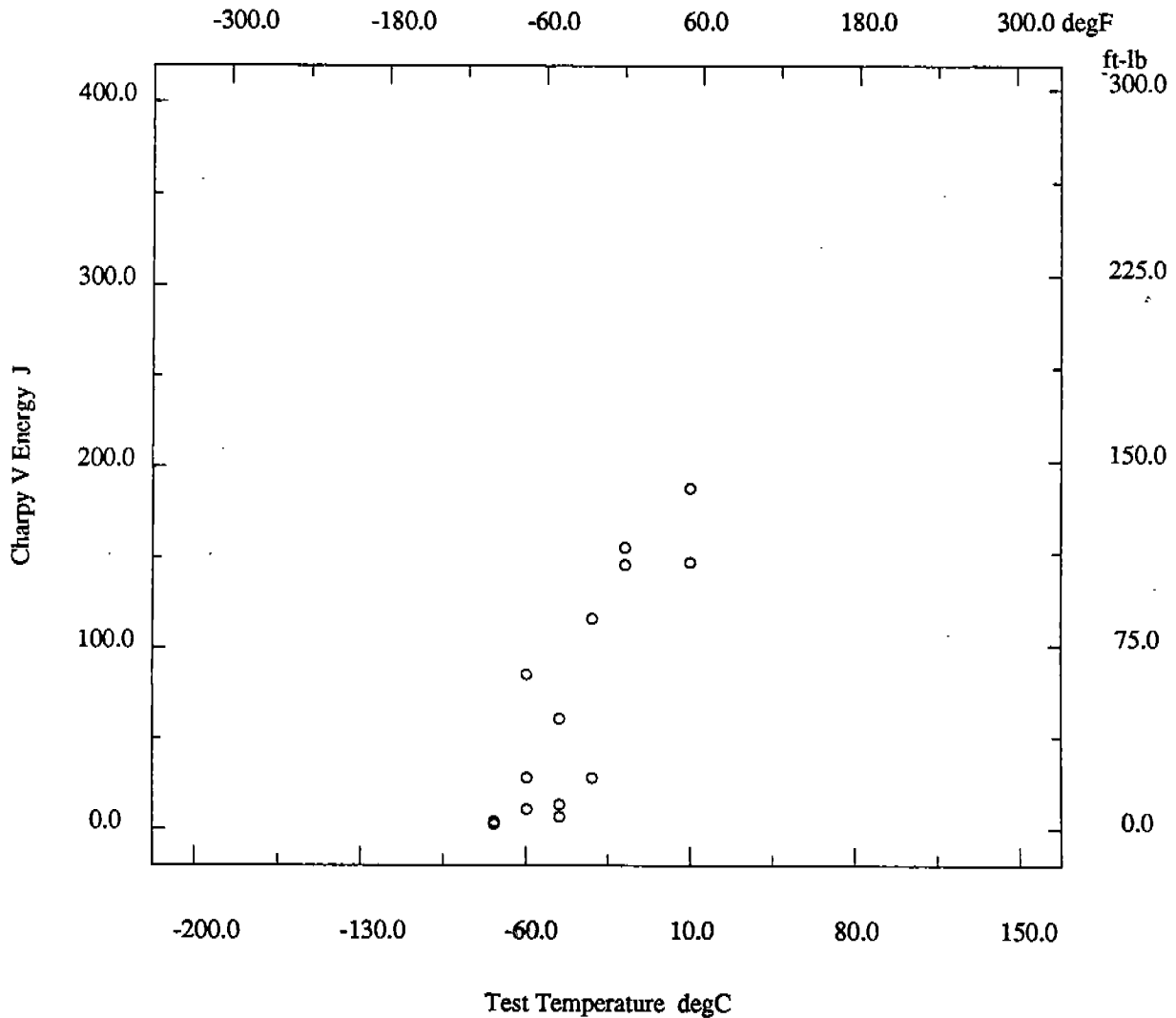
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Marine Structural Toughness Data Bank

Material A36

Page 3200.7

Description			
Material Code	009.002.02BS1	Material Name	A36
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

Marine Structural Toughness Data Bank

Material A36

Page 3200.8

Description	
Material Code	009.002.09BS2
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 3200.1

Fabrication History See Page 3200.1

Weld	
Weld Code	009.002.09BS2
Weld Type	SAW
Base Metal Thickness	1 in
Welding Position	Downhand IG
Preheat Temperature	50 degF
Metal Gap	5/16 in
Interpass Temperature	350 degF
Passes	7
Filler Specification	F72-EM12K
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	74 KJ/in
Joint Preparation	V Groove
Number of Sides	1
Location wrt Weld	11mm in HAZ
Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	1100 degF
Post-Weld Heat Time	5 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-100	11	13	20
L-T ◦	-100	8	10	25
L-T ◦	-75	29	22	35
L-T ◦	-75	39	33	40
L-T ◦	-50	36	38	45
L-T ◦	-50	65	57	55
L-T ◦	0	100	79	85
L-T ◦	0	104	74	90
L-T ◦	50	120	84	95
L-T ◦	50	138	91	100

* - not reported

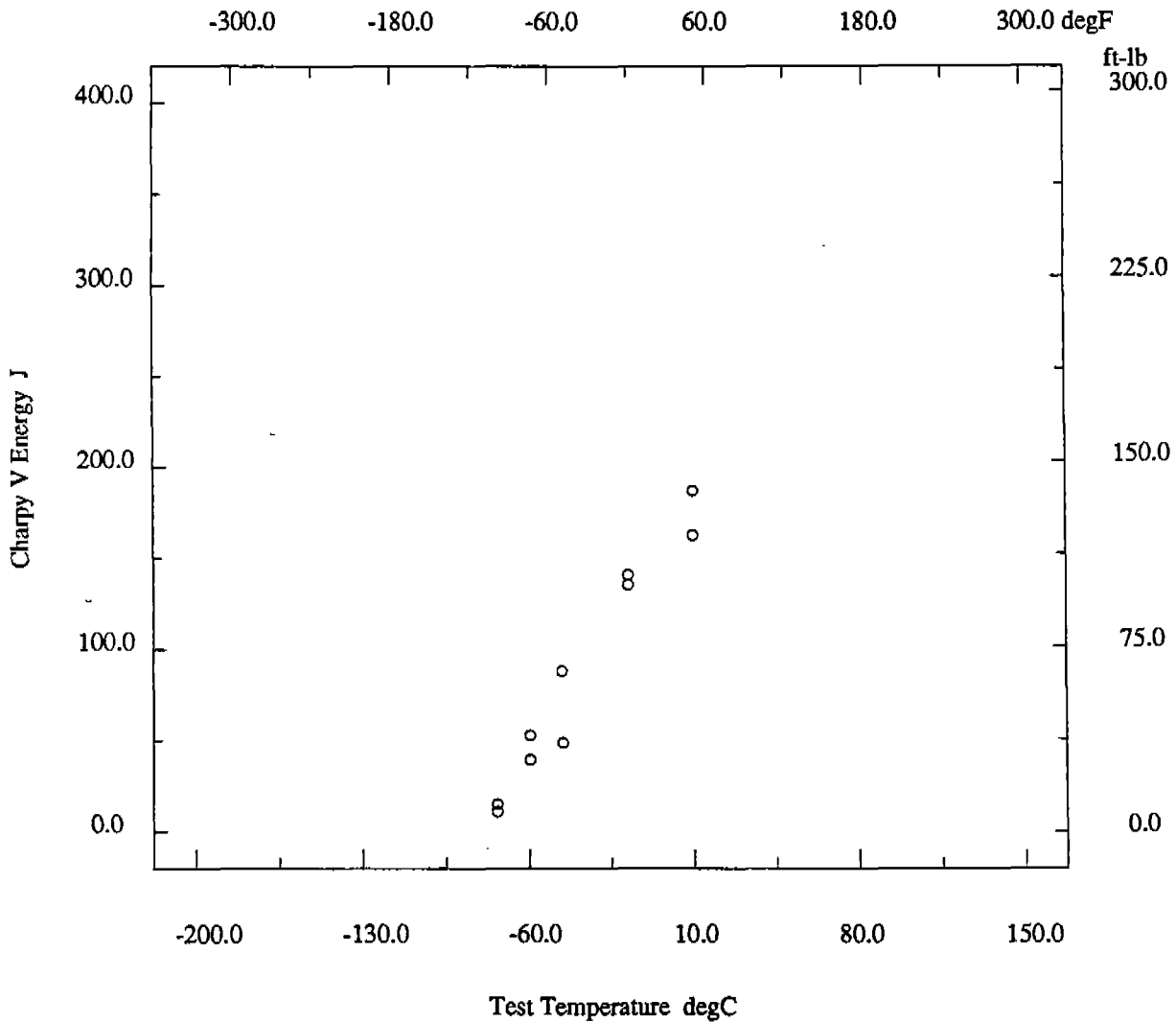
95

Marine Structural Toughness Data Bank

Material A36

Page 3200.9

Description				
Material Code	.....	009.002.09BS2	Material Name	..... A36
UNS	.....	*	Other Designation *
Type	.....	Welded Joint	Form	..... Plate
Thickness	1 in	Composition Type Actual
Composition Position	*	Lot ID *
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A36

Page 3200.10

Description	
Material Code	009.002.02BS2
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1
Composition	
See Page 3200.1	
Fabrication History	
See Page 3200.1	
Weld	
Weld Code	009.002.02BS2
Weld Type	SAW
Base Metal Thickness	1 in
Welding Position	Downhand IG
Preheat Temperature	50 degF
Metal Gap	5/16 in
Interpass Temperature	350 degF
Passes	7
Filler Specification	F72-EM12K
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	74 KJ/in
Joint Preparation	V Groove
Number of Sides	1
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	1100 degF
Post-Weld Heat Time	5 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No
Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-75	3	3	5
L-T ◦	-75	5	6	10
L-T ◦	-50	11	12	25
L-T ◦	-50	5	7	15
L-T ◦	-25	45	35	45
L-T ◦	-25	7	9	20
L-T ◦	0	142	87	100
L-T ◦	0	21	23	15
L-T ◦	0	98	73	90
L-T ◦	50	113	70	90
L-T ◦	50	126	77	85

* - not reported

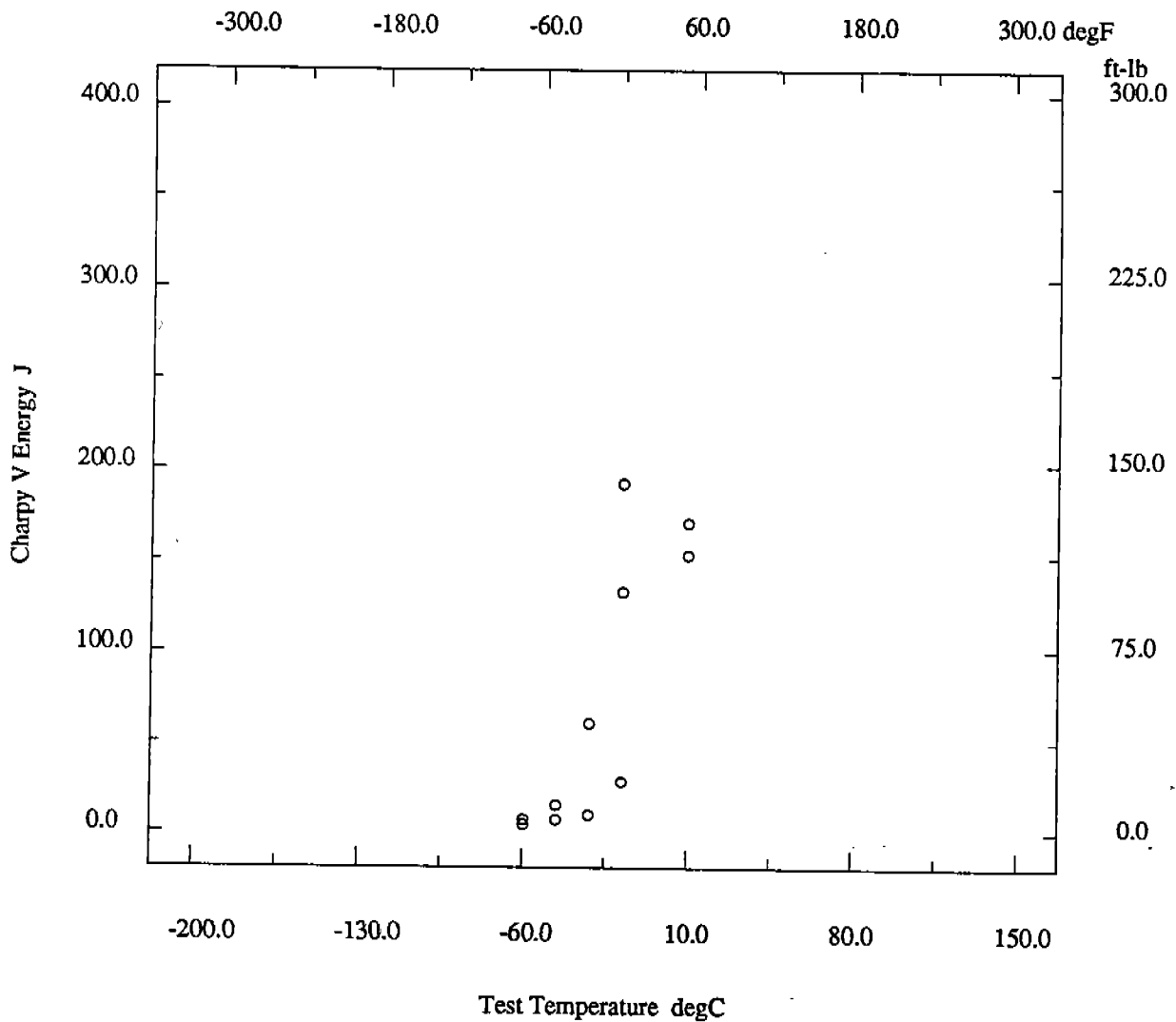


Marine Structural Toughness Data Bank

Material A36

Page 3200.11

Description			
Material Code	009.002.02BS2	Material Name	A36
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

Marine Structural Toughness Data Bank

Material A36

Page 3200.12

Description			
Material Code	009.002.09BS3	Material Name	A36
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		
Composition		See Page 3200.1	
Fabrication History		See Page 3200.1	
Weld			
Weld Code	009.002.09BS3	Weld Type	SAW
Base Metal Thickness	1 in	Welding Position	Downhand IG
Preheat Temperature	50 degF	Metal Gap	5/16 in
Interpass Temperature	350 degF	Passes	7
Filler Specification	F72-EM12K	Filler Name	*
Filler Carbon Content	*	Filler Metal Size	*
Shielding Gas	*	Voltage	*
Amperage	*	Polarity	*
Travel Speed	*	Heat Input/Pass	74 KJ/in
Joint Preparation	V Groove	Number of Sides	1
Location wrt Weld	11mm in HAZ	Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	1200 degF	Post-Weld Heat Time	1 hr
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		
Property Measurements			
Test Type	Charpy V Impact	Position	3/4T
Specimen Type	Full	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T °	-100	22	17	20
L-T °	-100	8	8	15
L-T °	-75	11	14	20
L-T °	-75	20	29	25
L-T °	-50	18	21	40
L-T °	-50	30	30	45
L-T °	-25	66	56	45
L-T °	-25	78	59	50
L-T °	0	101	74	85
L-T °	0	94	70	65
L-T °	50	122	85	90
L-T °	50	138	90	95

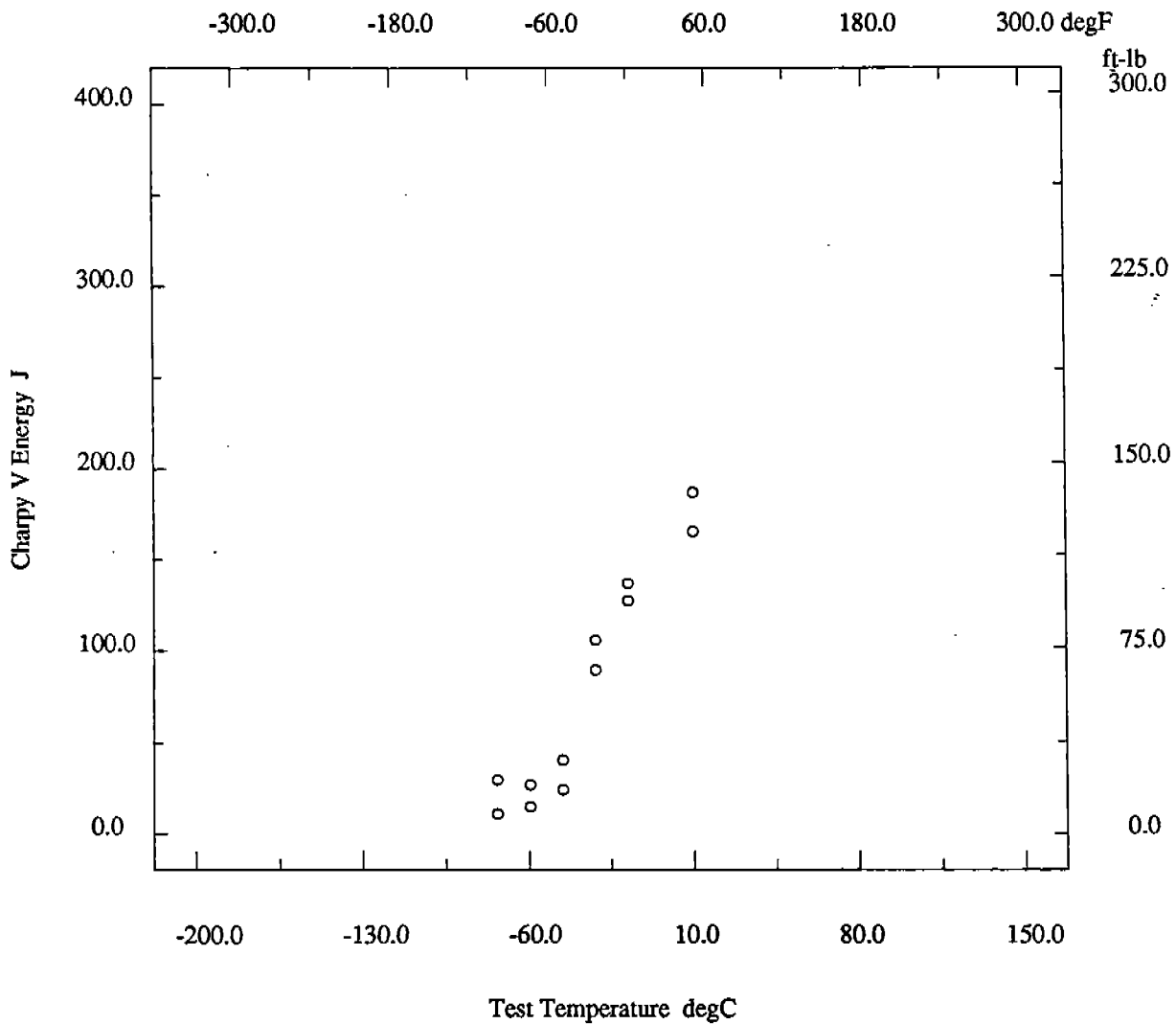
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Marine Structural Toughness Data Bank

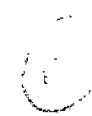
Material A36

Page 3200.13

Description	
Material Code	009.002.09BS3
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1



* - not reported



Marine Structural Toughness Data Bank

Material A36

Page 3200.14

Description			
Material Code	009.002.02BS3	Material Name	A36
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		
Composition		See Page 3200.1	
Fabrication History		See Page 3200.1	
Weld			
Weld Code	009.002.02BS3	Weld Type	SAW
Base Metal Thickness	1 in	Welding Position	Downhand IG
Preheat Temperature	50 degF	Metal Gap	5/16 in
Interpass Temperature	350 degF	Passes	7
Filler Specification	F72-EM12K	Filler Name	*
Filler Carbon Content	*	Filler Metal Size	*
Shielding Gas	*	Voltage	*
Amperage	*	Polarity	*
Travel Speed	*	Heat Input/Pass	74 KJ/in
Joint Preparation	V Groove	Number of Sides	1
Location wrt Weld	Fusion line	Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	1200 degF	Post-Weld Heat Time	1 hr
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		
Property Measurements			
Test Type	Charpy V Impact	Position	3/4T
Specimen Type	Full	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◊	-75	3	5	10
L-T ◊	-75	5	6	10
L-T ◊	-50	15	13	25
L-T ◊	-50	35	25	30
L-T ◊	-25	101	73	80
L-T ◊	-25	108	60	75
L-T ◊	0	120	73	80
L-T ◊	0	135	80	100
L-T ◊	50	120	71	90
L-T ◊	50	132	78	95

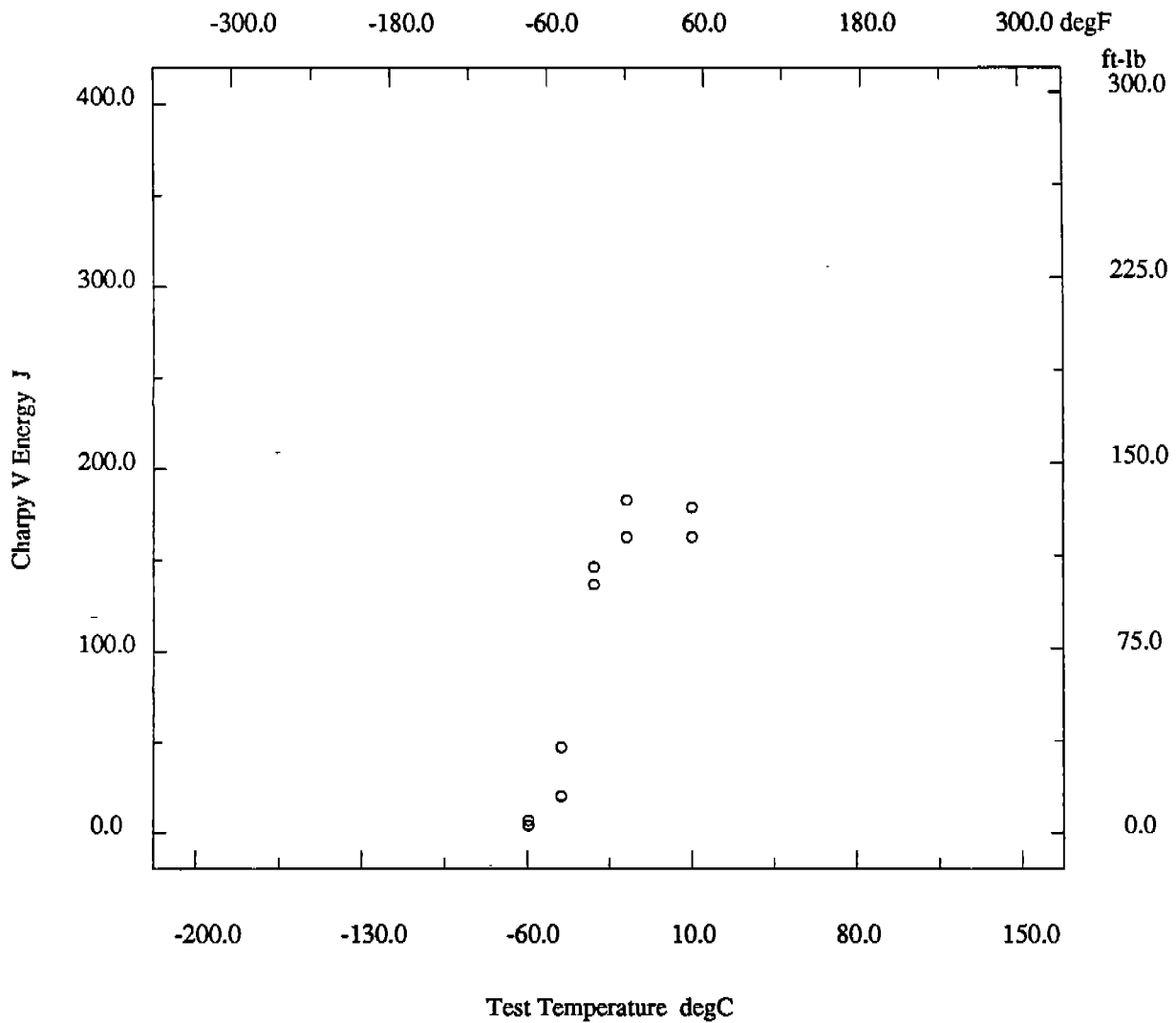
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Marine Structural Toughness Data Bank

Material A36

Page 3200.15

Description		Material Name
Material Code	009.002.02BS3	A36
UNS	*	Other Designation
Type	Welded Joint	Form
Thickness	1 in	Composition Type
Composition Position	*	Lot ID
Reference	KONKUL-1	



* - not reported



Marine Structural Toughness Data Bank

Material A36

Page 3200.16

Description	
Material Code	009.002.09BS4
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 3200.1

Fabrication History See Page 3200.1

Weld	
Weld Code	009.002.09BS4
Weld Type	SAW
Base Metal Thickness	1 in
Welding Position	Downhand IG
Preheat Temperature	50 degF
Metal Gap	5/16 in
Interpass Temperature	350 degF
Passes	7
Filler Specification	F72-EM12K
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	74 KJ/in
Joint Preparation	V Groove
Number of Sides	1
Location wrt Weld	11mm in HAZ
Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	1200 degF
Post-Weld Heat Time	5 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-100	4	4	10
L-T ◦	-100	8	8	10
L-T ◦	-75	15	18	20
L-T ◦	-75	9	12	25
L-T ◦	-50	38	34	35
L-T ◦	-50	43	36	40
L-T ◦	-25	81	68	65
L-T ◦	-25	94	76	75
L-T ◦	0	111	80	80
L-T ◦	0	113	80	50
L-T ◦	50	157	80	100
L-T ◦	50	165	86	100

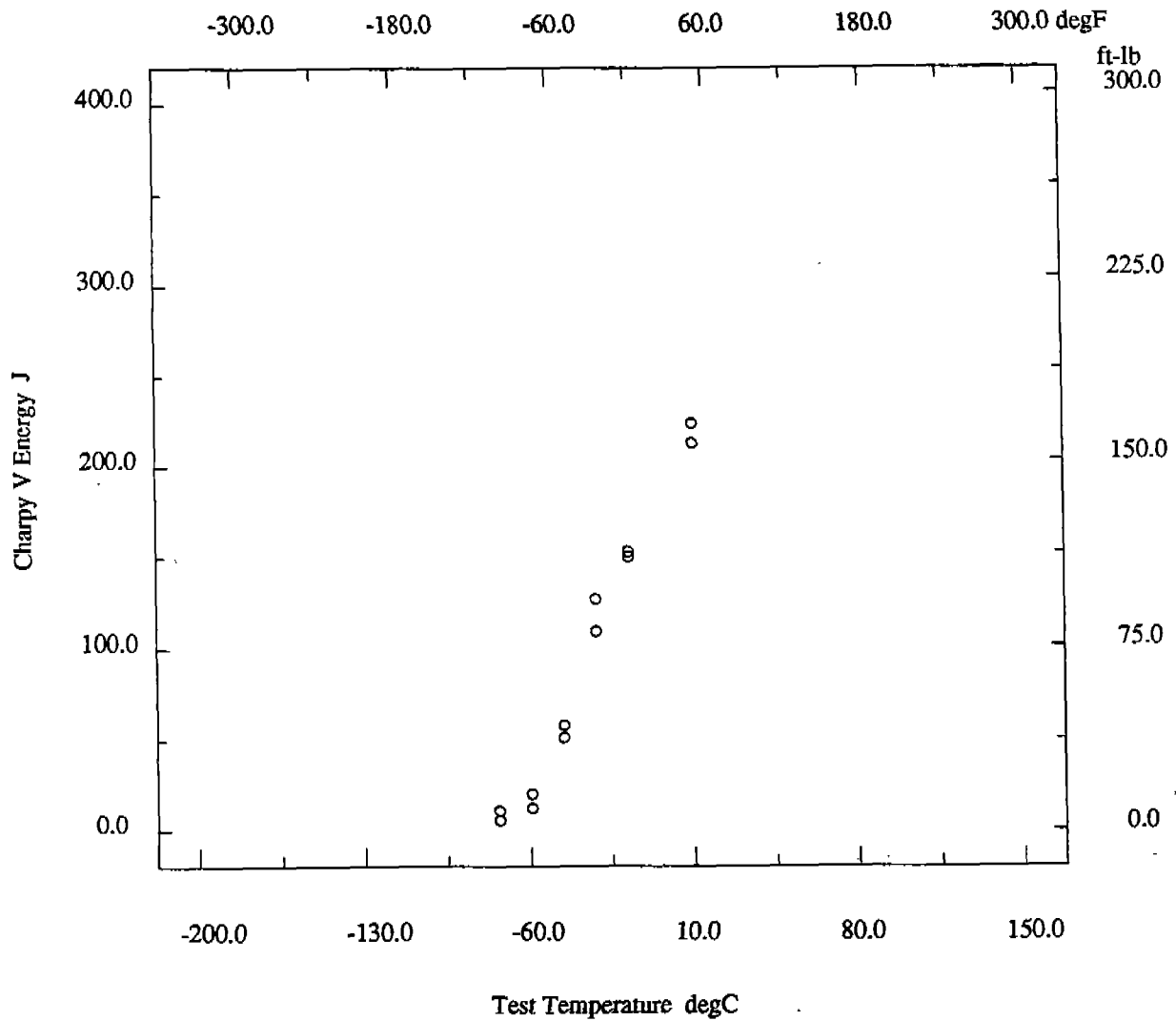
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Marine Structural Toughness Data Bank

Material A36

Page 3200.17

Description	
Material Code	009.002.09BS4
UNS	*
Type	Welded Joint
Thickness	1 in
Composition Position	*
Reference	KONKUL-1
Material Name	A36
Other Designation	*
Form	Plate
Composition Type	Actual
Lot ID	*



* - not reported



Marine Structural Toughness Data Bank

Material A36

Page 3200.18

Description	
Material Code	009.002.02BS4
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 3200.1

Fabrication History See Page 3200.1

Weld	
Weld Code	009.002.02BS4
Weld Type	SAW
Base Metal Thickness	1 in
Welding Position	Downhand IG
Preheat Temperature	50 degF
Metal Gap	5/16 in
Interpass Temperature	350 degF
Passes	7
Filler Specification	F72-EM12K
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	74 KJ/in
Joint Preparation	V Groove
Number of Sides	1
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	1200 degF
Post-Weld Heat Time	5 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-75	2	3	5
L-T ◦	-75	2	3	5
L-T ◦	-50	5	8	10
L-T ◦	-50	6	8	20
L-T ◦	-25	13	9	20
L-T ◦	-25	5	3	10
L-T ◦	0	42	37	40
L-T ◦	0	67	57	35
L-T ◦	50	119	79	90

* - not reported

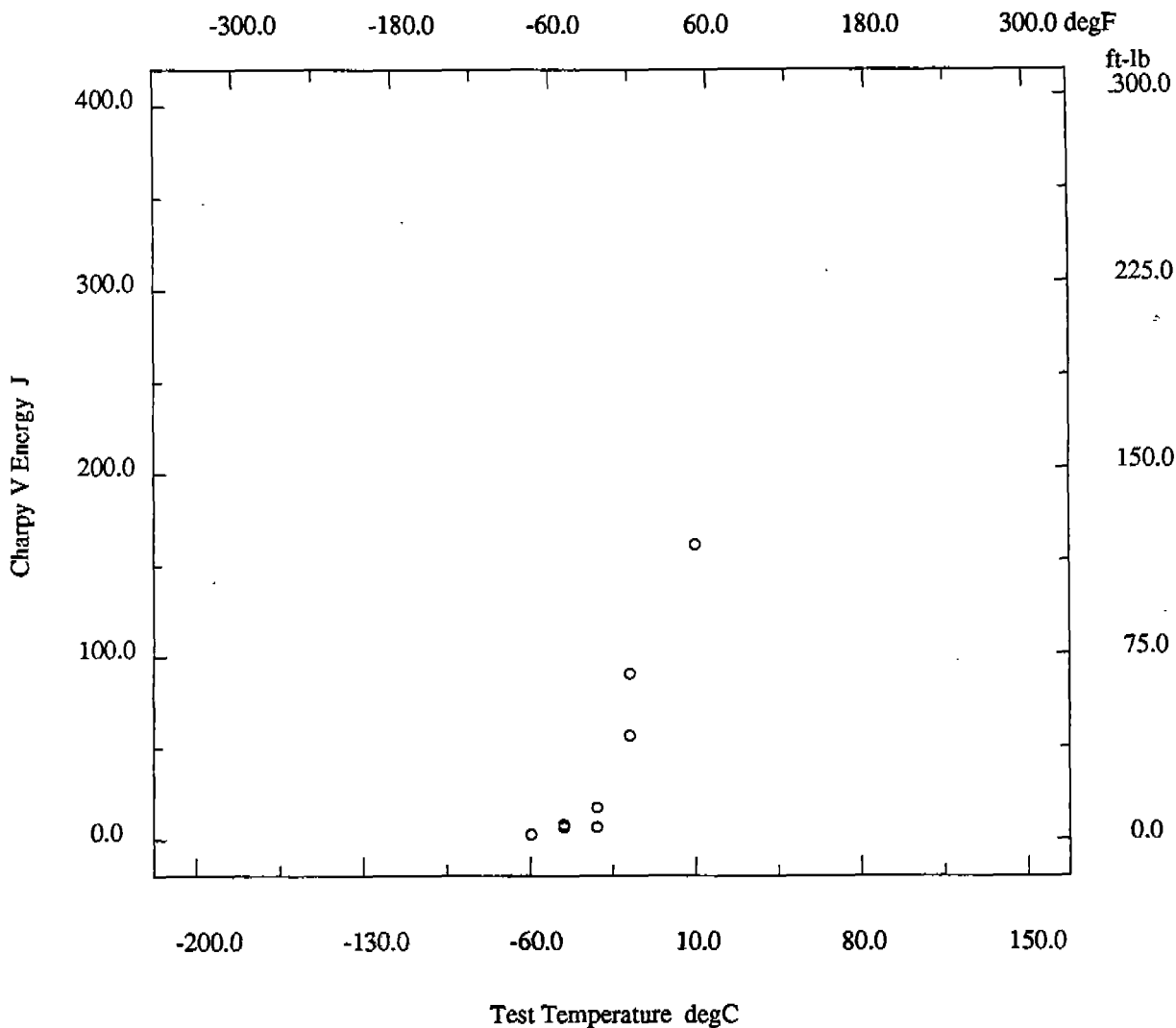


Marine Structural Toughness Data Bank

Material A36

Page 3200.19

Description	
Material Code	009.002.02BS4
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1



* - not reported

(100)

Marine Structural Toughness Data Bank

Material A36

Page 3200.20

Description	
Material Code	009.002.09BS1
Material Name	A36
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 3200.1

Fabrication History See Page 3200.1

Weld	
Weld Code	009.002.09BS1
Weld Type	SAW
Base Metal Thickness	1 in
Welding Position	Downhand IG
Preheat Temperature	50 degF
Metal Gap	5/16 in
Interpass Temperature	350 degF
Passes	7
Filler Specification	F72-EM12K
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	74 KJ/in
Joint Preparation	V Groove
Number of Sides	1
Location wrt Weld	11mm in HAZ
Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	1100 degF
Post-Weld Heat Time	1 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-100	12	8	10
L-T ◦	-100	5	4	10
L-T ◦	-75	20	13	25
L-T ◦	-75	35	25	20
L-T ◦	-50	23	22	35
L-T ◦	-50	27	25	30
L-T ◦	-25	55	45	30
L-T ◦	-25	63	49	35
L-T ◦	0	105	78	80
L-T ◦	0	70	62	70
L-T ◦	50	121	85	95
L-T ◦	50	125	88	95

* - not reported

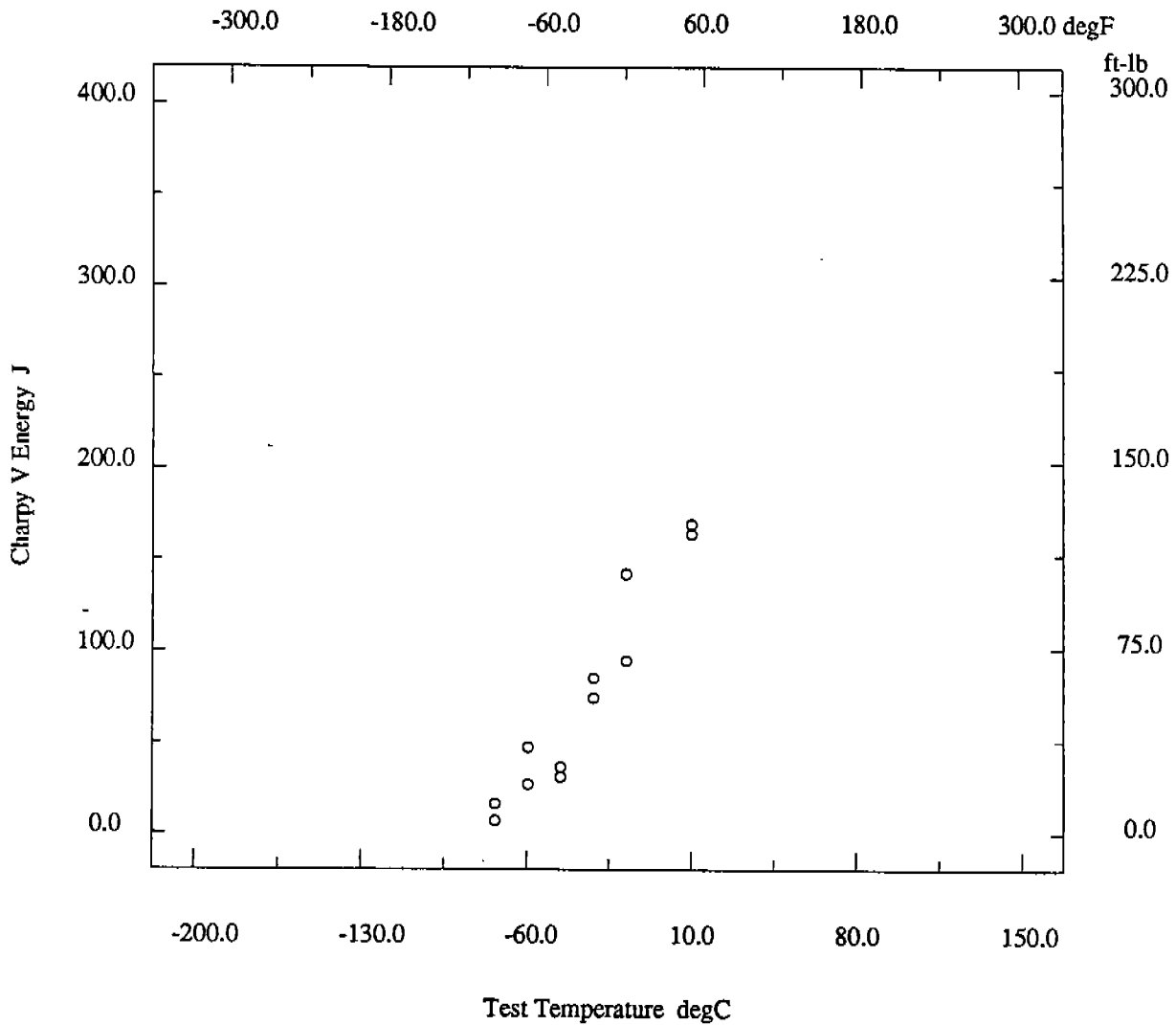


Marine Structural Toughness Data Bank

Material A36

Page 3200.21

Description			
Material Code	009.002.09BS1	Material Name	A36
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material CG A537M

Page 7100.1

Description	
Material Code	003.001.01
Material Name	CG A537M
UNS	*
Other Designation	Grade B
Type	Wrought Metal
Form	Plate
Thickness	1.058 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	SSC-276

Composition			
C	0.15 %	Mn	1.20 %
P	0.01 %	S	0.021 %
Si	0.40 %	Cr	0.23 %
Ni	0.13 %	Mo	0.04 %
V	*	Cu	0.08 %
Cb	*	Ti	*
B	*	Al	0.03 %
N	*	Other Components	None %

Fabrication History			
Heat Treatment	Q,T	Producer	Armco
Year Produced	*	Addl Info	*
Source	SWRI	Melting Practice	*
Ingot Position	*	Killing Process	*
Process Temperature	*	Process Time	*
Rolling Conditions	*	Final Processing	Q,T
Final Temperature	*	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Tensile	Position	1/4T
Specimen Type	Round	Specimen Thickness	0.25 in
Gage Length	1.0 in	Loading Rate	*
Tensile Strength Offset	*	Uniform Elongation	*
Tensile Modulus	*	Standard Method	E 8
Standard Year	*		

Orient	Test Temp degF	UTS ksi	TYS ksi	TYP ksi	Elongation %	RA %
L	Room	82	61.8	*	29.7	73.9

* - not reported

3

Marine Structural Toughness Data Bank

Material CG A537M

Page 7100.2

Description	
Material Code	003.001.01
Material Name	CG A537M
UNS	*
Other Designation	Grade B
Type	Wrought Metal
Form	Plate
Thickness	1.058 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	SSC-276

Composition See Page 7100.1

Fabrication History See Page 7100.1

Property Measurements	
Test Type	Charpy V Impact
Position	1/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	E 23
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-80	24	0.039	45
L-T ◦	-80	32	0.041	34
L-T ◦	-80	38	0.026	32
L-T ◦	-40	70	0.069	100
L-T ◦	-40	75	0.058	62
L-T ◦	-40	78	0.071	100
L-T ◦	0	74	0.071	100
L-T ◦	0	76	0.067	100
L-T ◦	0	78	0.064	100
L-T ◦	32	74	0.067	100
L-T ◦	32	74	0.071	100
L-T ◦	32	75	0.065	100
L-T ◦	75	79	0.066	100
L-T ◦	75	80	0.075	100
L-T ◦	75	82	0.065	100

* - not reported

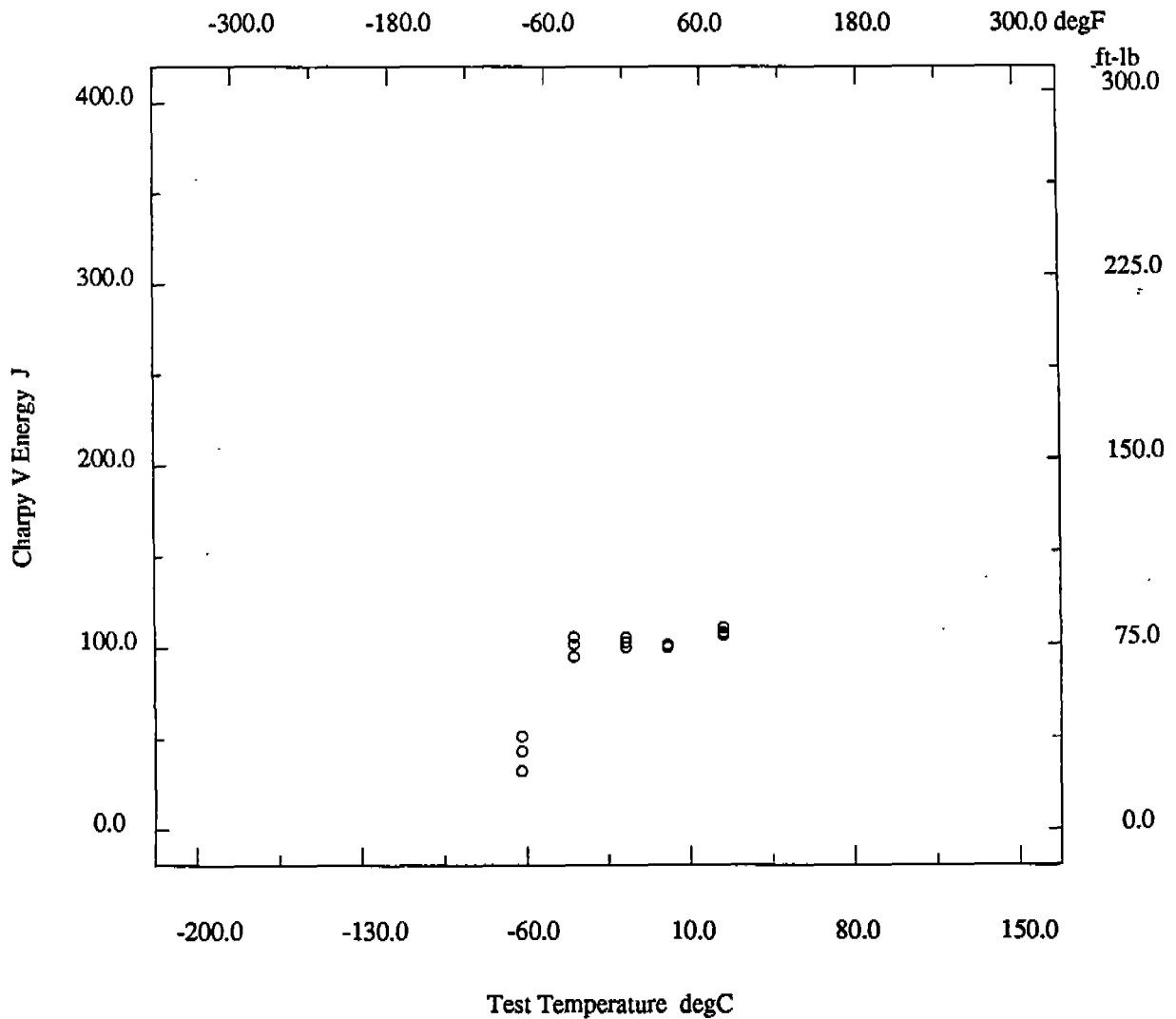


Marine Structural Toughness Data Bank

Material CG A537M

Page 7100.3

Description			
Material Code	003.001.01	Material Name	CG A537M
UNS	*	Other Designation	Grade B
Type	Wrought Metal	Form	Plate
Thickness	1.058 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	SSC-276		



* - not reported

Marine Structural Toughness Data Bank

Material CG A537M

Page 7100.4

Description			
Material Code	003.001.01	Material Name	CG A537M
UNS	*	Other Designation	Grade B
Type	Wrought Metal	Form	Plate
Thickness	1.058 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	SSC-276		

Composition See Page 7100.1

Fabrication History See Page 7100.1

Property Measurements			
Test Type	Nil Ductility Transition	Position	0/4T
Specimen Type	P-3	Filler Alloy	Hardex-N
Passes	*	Standard Method	E 208
Standard Year	*		

Orien	Test Temp degF	Break?	NDTT
L	-90	Yes	No
L	-80	No	No
L	-80	Yes	No
L	-70	No	No
L	-70	Yes	Yes
L	-60	No	No

* - not reported

Marine Structural Toughness Data Bank

Material CG A537M

Page 7100.5

Description			
Material Code	003.001.01	Material Name	CG A537M
UNS	*	Other Designation	Grade B
Type	Wrought Metal	Form	Plate
Thickness	1.058 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	SSC-276		
Composition		See Page 7100.1	
Fabrication History		See Page 7100.1	
Property Measurements			
Test Type	Dynamic Tear	Position	0/4T
Specimen Type	Dynamic Tear	Notch Preparation	Pressed
Specimen Thickness	5/8 in	Loading Rate	*
Appearance	*	Standard Method	E 604
Standard Year	1976		

Orien	Test Temp degF	DT Energy ft-lb
L-T ◯	-110	35
L-T ◯	-80	70
L-T ◯	-40	320
L-T ◯	0	665
L-T ◯	72	790
L-T ◯	120	885
T-L △	-100	55
T-L △	0	420
T-L △	75	420

* - not reported

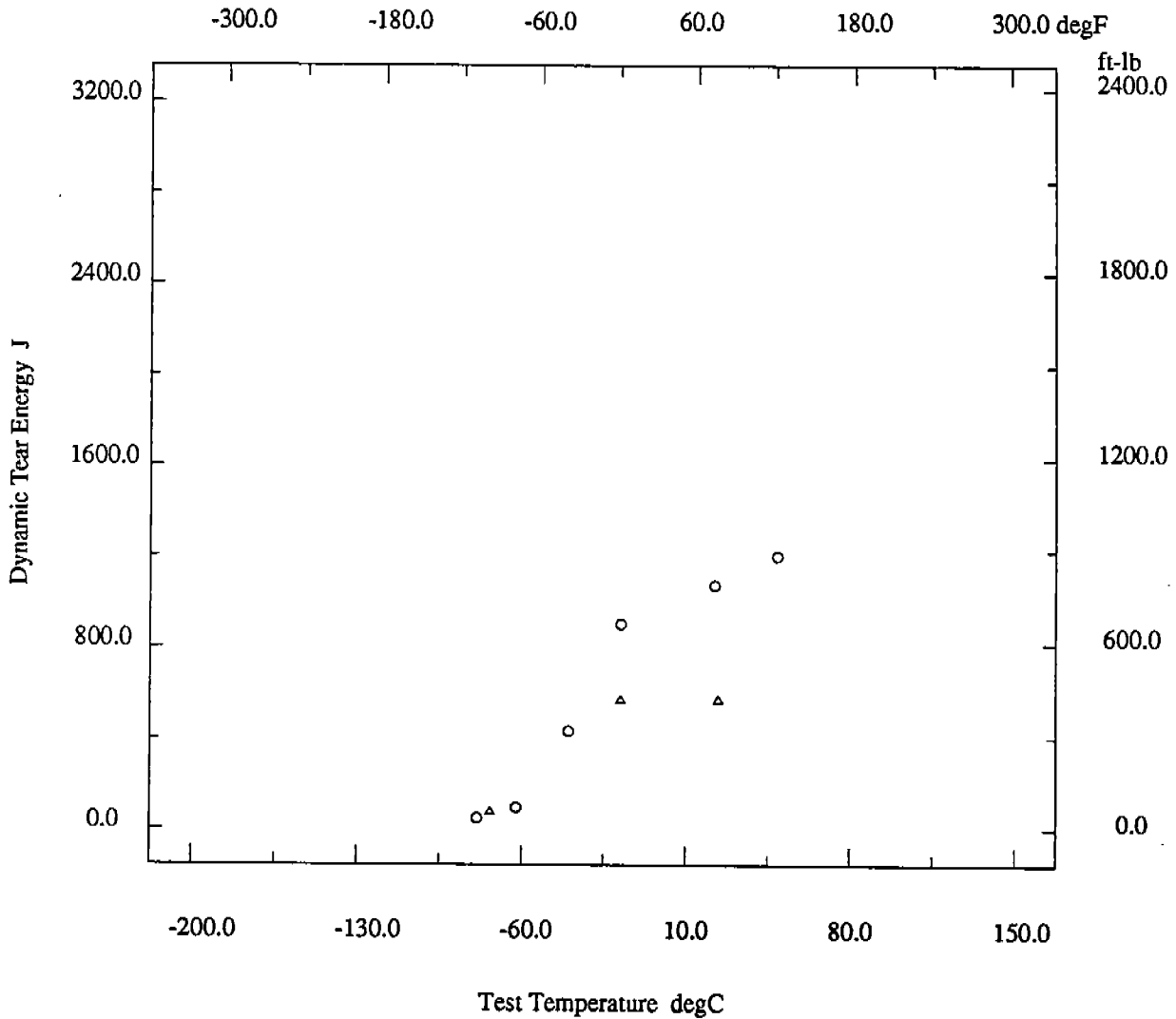


Marine Structural Toughness Data Bank

Material CG A537M

Page 7100.6

Description			
Material Code	003.001.01	Material Name	CG A537M
UNS	*	Other Designation	Grade B
Type	Wrought Metal	Form	Plate
Thickness	1.058 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	SSC-276		



* - not reported

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Marine Structural Toughness Data Bank

Material CG A537M

Page 7200.1

Description	
Material Code	003.002.01
Material Name	CG A537M
UNS	*
Other Designation	Grade B
Type	Wrought Metal
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	*

Composition			
C	0.17 %	Mn	1.32 %
P	0.01 %	S	0.019 %
Si	0.33 %	Cr	0.21 %
Ni	0.25 %	Mo	0.06 %
V	*	Cu	0.14 %
Cb	*	Ti	*
B	*	Al	0.02 %
N	*	Other Components	None %

Fabrication History			
Heat Treatment	Q,T	Producer	Armco
Year Produced	*	Addl Info	None
Source	SWRI	Melting Practice	*
Ingot Position	*	Killing Process	*
Process Temperature	*	Process Time	*
Rolling Conditions	*	Final Processing	Q,T
Final Temperature	*	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Tensile	Position	1/4T
Specimen Type	Round	Specimen Thickness	0.250 in
Gage Length	1.00 in	Loading Rate	*
Tensile Strength Offset	*	Uniform Elongation	*
Tensile Modulus	*	Standard Method	E 8
Standard Year	*		

Orient	Test Temp degF	UTS ksi	TYS ksi	TYP ksi	Elongation %	RA %
L	Room	89.6	69.0	*	22.7	68.7

* - not reported

Marine Structural Toughness Data Bank

Material CG A537M

Page 7200.2

Description	
Material Code	003.002.01
Material Name	CG A537M
UNS	*
Other Designation	Grade B
Type	Wrought Metal
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	*

Composition See Page 7200.1

Fabrication History See Page 7200.1

Property Measurements	
Test Type	Charpy V Impact
Position	1/4T
Specimen Type	Full
Did Specimen Fracture?	*
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-80	27.0	0.025	46
L-T ◦	-80	28.0	0.028	51
L-T ◦	-80	34.0	0.033	61
L-T ◦	-40	47.0	0.041	85
L-T ◦	-40	49.0	0.045	100
L-T ◦	-40	52.5	0.048	100
L-T ◦	0	49.5	0.048	100
L-T ◦	0	56.0	0.048	100
L-T ◦	0	80.0	0.064	100
L-T ◦	32	53.0	0.047	100
L-T ◦	32	53.0	0.049	100
L-T ◦	32	54.0	0.051	100
L-T ◦	75	49.5	0.049	100
L-T ◦	75	50.0	0.050	100
L-T ◦	75	55.0	0.051	100

* - not reported

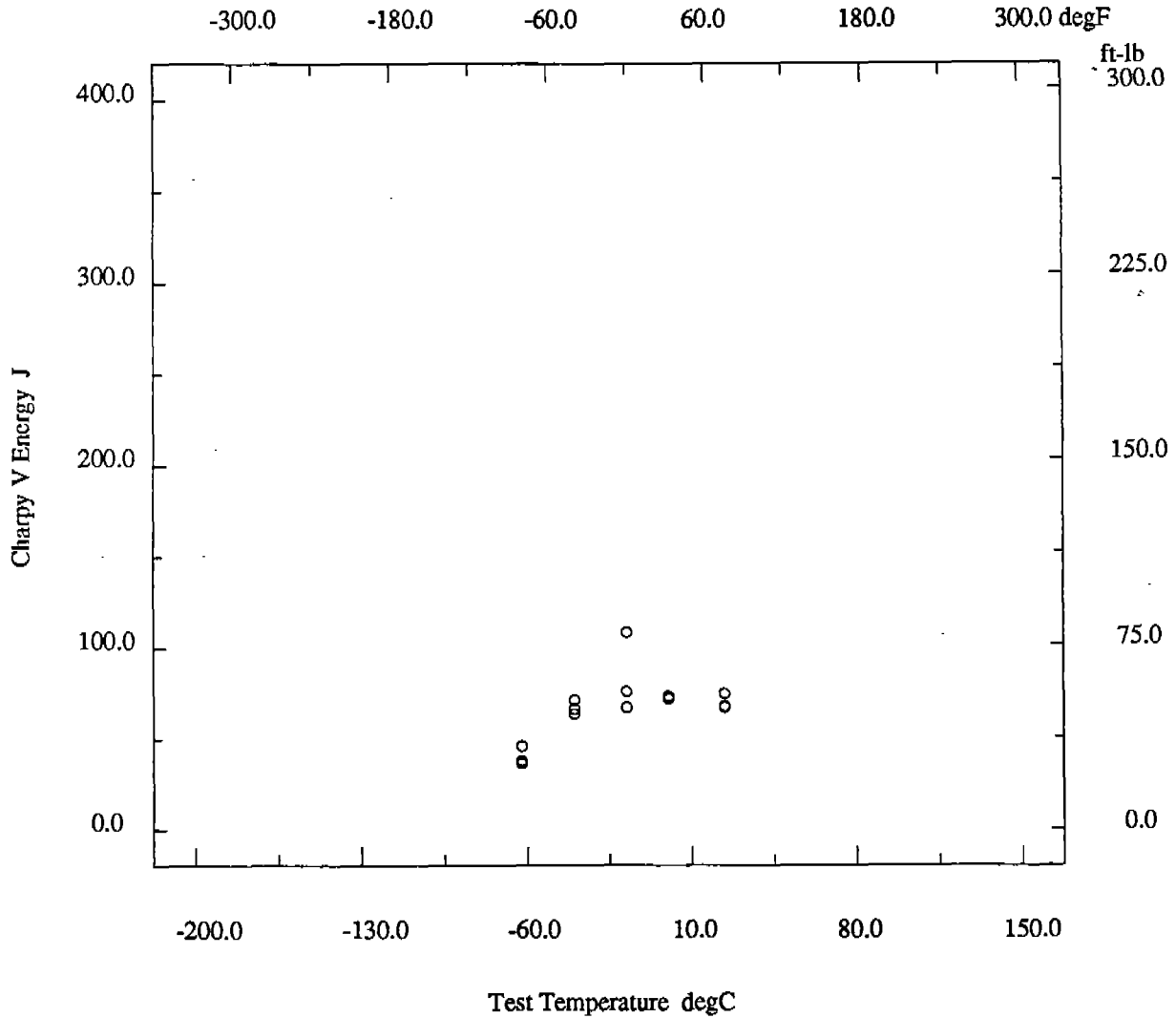


Marine Structural Toughness Data Bank

Material CG A537M

Page 7200.3

Description			
Material Code	003.002.01	Material Name	CG A537M
UNS	*	Other Designation	Grade B
Type	Wrought Metal	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	*		



* - not reported

Matne Structural Toughness Data Bank

Material CG A537M

Page 7200.4

Description	
Material Code	003.002.01
Material Name	CG A537M
UNS	*
Other Designation	Grade B
Type	Wrought Metal
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	*

Composition See Page 7200.1

Fabrication History See Page 7200.1

Property Measurements	
Test Type	Nil Ductility Transition
Position	0/4T
Specimen Type	P-3
Filler Alloy	Hardex-N
Passes	*
Standard Method	E 208
Standard Year	*

Orien	Test Temp degF	Break?	NDTT
L	-90	Yes	No
L	-80	No	No
L	-80	Yes	No
L	-70	Yes	Yes
L	-60	No	No

* - not reported



Marine Structural Toughness Data Bank

Material CG A537M

Page 7200.5

Description	
Material Code	003.002.01
Material Name	CG A537M
UNS	*
Other Designation	Grade B
Type	Wrought Metal
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	*

Composition See Page 7200.1

Fabrication History See Page 7200.1

Property Measurements	
Test Type	Dynamic Tear
Position	0/4T
Specimen Type	Dynamic Tear
Notch Preparation	Pressed
Specimen Thickness	5/8 in
Loading Rate	*
Appearance	*
Standard Method	E 604
Standard Year	1976

Orien	Test Temp degF	DT Energy ft-lb
L-T ◯	-110	45
L-T ◯	-80	90
L-T ◯	-40	195
L-T ◯	-20	350
L-T ◯	0	540
L-T ◯	72	550
T-L ▲	-100	95
T-L ▲	0	665
T-L ▲	75	640

* - not reported

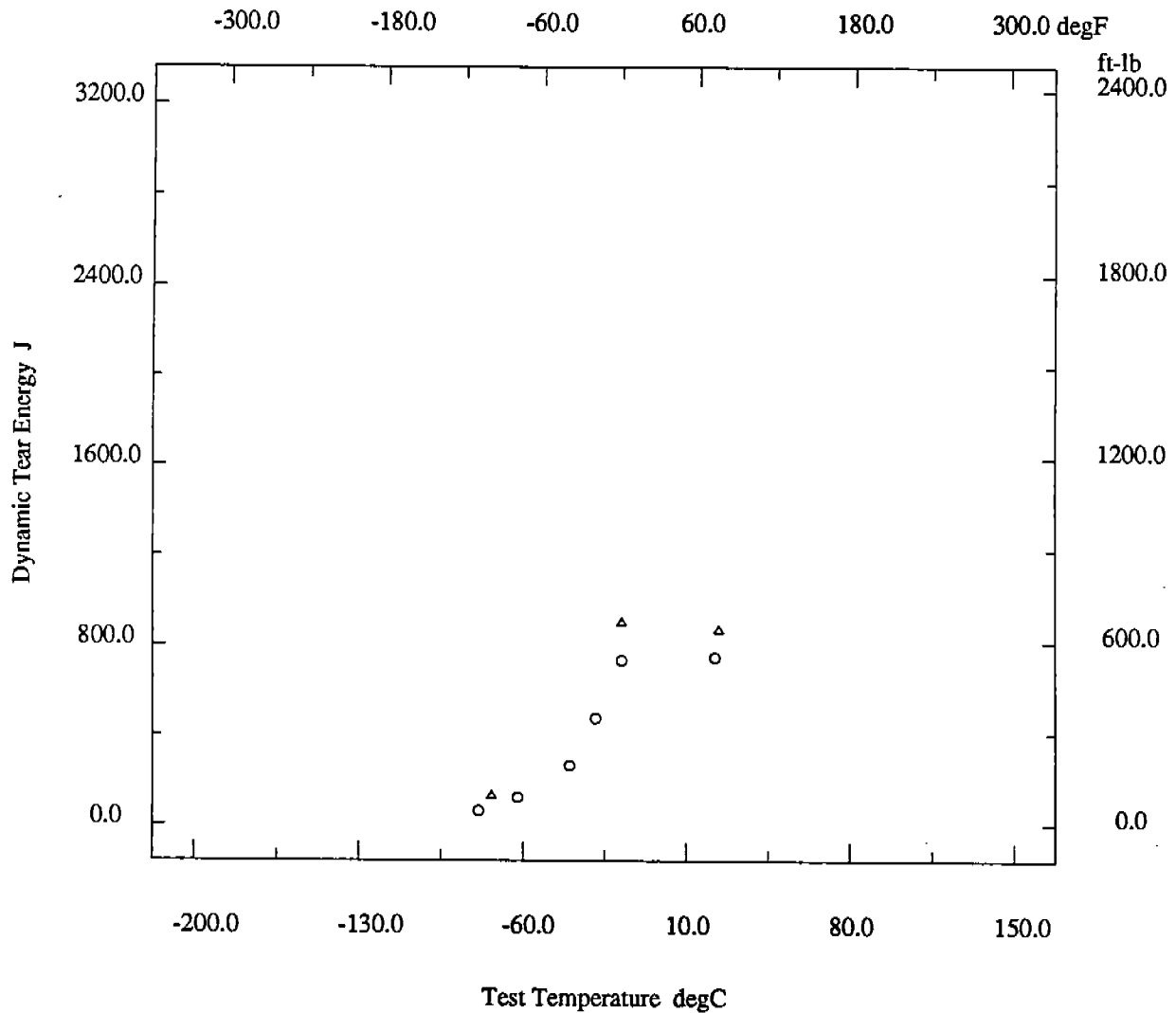


Marine Structural Toughness Data Bank

Material CG A537M

Page 7200.6

Description			
Material Code	003.002.01	Material Name	CG A537M
UNS	*	Other Designation	Grade B
Type	Wrought Metal	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	*		



* - not reported

Marine Structural Toughness Data Bank

Material CG A537M

Page 7200.7

Description	
Material Code	003.002.09
Material Name	CG A537M
UNS	*
Other Designation	Grade B
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	*

Composition See Page 7200.1

Fabrication History See Page 7200.1

Weld	
Weld Code	003.002.09
Weld Type	SAW
Base Metal Thickness	1.0 in
Welding Position	Downhand
Preheat Temperature	150 degF
Metal Gap	0 in
Interpass Temperature	300 degF
Passes	*
Filler Specification	*
Filler Name	Armco W18
Filler Carbon Content	*
Filler Metal Size	5/32 in
Shielding Gas	*
Voltage	30 volts
Amperage	475 amps
Polarity	DCRP
Travel Speed	18 in/min
Heat Input/Pass	50 KJ/in
Joint Preparation	Double V-Groove
Number of Sides	2
Location wrt Weld	11mm in HAZ
Location wrt Surface	1/4T
Post-Weld Heat Temp	*
Post-Weld Heat Time	*
Flux Type	*
Flux Name	Linc 860
Weld Composition Reported?	No

Property Measurements	
Test Type	Tensile
Position	1/4T
Specimen Type	Round
Specimen Thickness	0.250 in
Gage Length	1.25 in
Loading Rate	*
Tensile Strength Offset	*
Uniform Elongation	*
Tensile Modulus	*
Standard Method	E 8
Standard Year	*

Orient	Test Temp degF	UTS ksi	TYS ksi	TYP ksi	Elongation %	RA %
L	Room	71.1	86.6	*	16.2	61.2

* - not reported

Marine Structural Toughness Data Bank

Material CG A537M

Page 7200.8

Description	
Material Code	003.002.09.1
Material Name	CG A537M
UNS	*
Other Designation	Grade B
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	*
Composition	See Page 7200.1
Fabrication History	See Page 7200.1
Weld	
Weld Code	003.002.09.1
Weld Type	SAW
Base Metal Thickness	1.0 in
Welding Position	Downhand
Preheat Temperature	150 degF
Metal Gap	0 in
Interpass Temperature	300 degF
Passes	*
Filler Specification	*
Filler Name	Armco W18
Filler Carbon Content	*
Filler Metal Size	5/32 in
Shielding Gas	*
Voltage	30 volts
Amperage	475 amps
Polarity	DCRP
Travel Speed	18 in/min
Heat Input/Pass	50 KJ/in
Joint Preparation	Double V-Groove
Number of Sides	2
Location wrt Weld	11mm in HAZ
Location wrt Surface	1/4T
Post-Weld Heat Temp	*
Post-Weld Heat Time	*
Flux Type	*
Flux Name	Linc 860
Weld Composition Reported?	No
Property Measurements	
Test Type	Charpy V Impact
Position	1/4T
Specimen Type	Full
Shear Fracture	*
Did Specimen Fracture?	*
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils
L-T ◦	-100	11.0	0.013
L-T ◦	-100	14.5	0.015
L-T ◦	-100	15.5	0.017
L-T ◦	-60	29.5	0.031
L-T ◦	-60	30.5	0.031
L-T ◦	-60	31.5	0.033
L-T ◦	-20	44.5	0.043
L-T ◦	-20	47.0	0.045
L-T ◦	-20	48.0	0.045
L-T ◦	32	54.5	0.052
L-T ◦	32	57.0	0.057
L-T ◦	32	62.0	0.047
L-T ◦	75	64.0	0.063
L-T ◦	75	66.0	0.066
L-T ◦	75	69.0	0.067

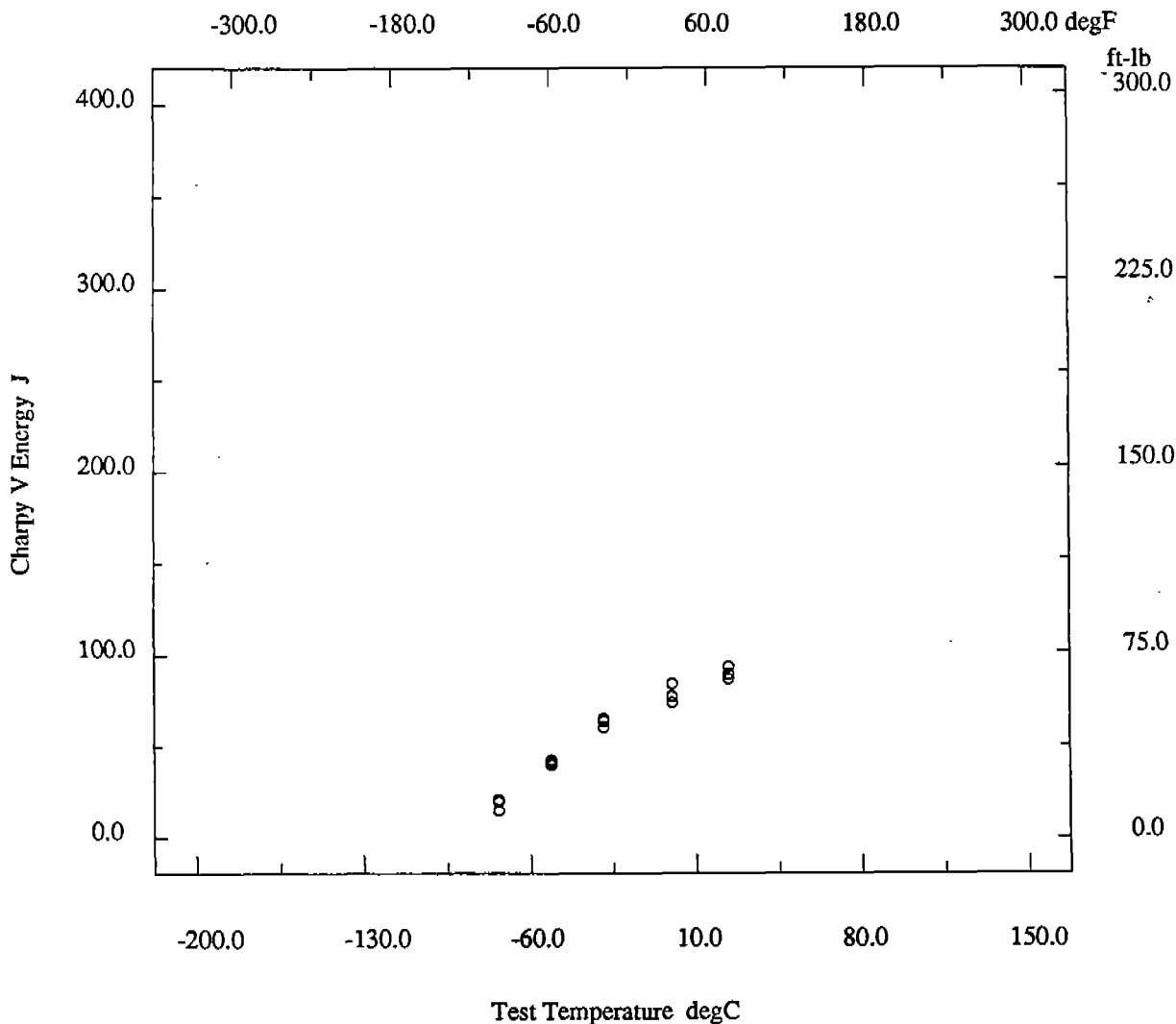
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Marine Structural Toughness Data Bank

Material CG A537M

Page 7200.9

Description			
Material Code	003.002.09.1	Material Name	CG A537M
UNS	*	Other Designation	Grade B
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	*		



* - not reported

Marine Structural Toughness Data Bank

Material CG A537M

Page 7200.10

Description	
Material Code	003.002.09.1
Material Name	CG A537M
UNS	*
Other Designation	Grade B
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	*

Composition See Page 7200.1

Fabrication History See Page 7200.1

Weld See Page 7200.8

Property Measurements	
Test Type	Nil Ductility Transition
Position	0/4T
Specimen Type	P-3
Filler Alloy	Hardex-N
Passes	*
Standard Method	E 208
Standard Year	*

Orien	Test Temp degF	Break?	NDTT
L	-100	No	No
L	-100	No	No
L	-60	No	No

* - not reported

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Marine Structural Toughness Data Bank

Material CG A537M

Page 7200.11

Description			
Material Code	003.002.09.1	Material Name	CG A537M
UNS	*	Other Designation	Grade B
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	*		
Composition		See Page 7200.1	
Fabrication History		See Page 7200.1	
Weld		See Page 7200.8	
Property Measurements			
Test Type	Dynamic Tear	Position	0/4T
Specimen Type	Dynamic Tear	Notch Preparation	Pressed
Specimen Thickness	5/8 in	Loading Rate	*
Appearance	*	Standard Method	E 604
Standard Year	1976		

Orien	Test Temp degF	DT Energy ft-lb
T-L ◦	-80	100
T-L ◦	-40	180
T-L ◦	0	440
T-L ◦	75	700
T-L ◦	120	670

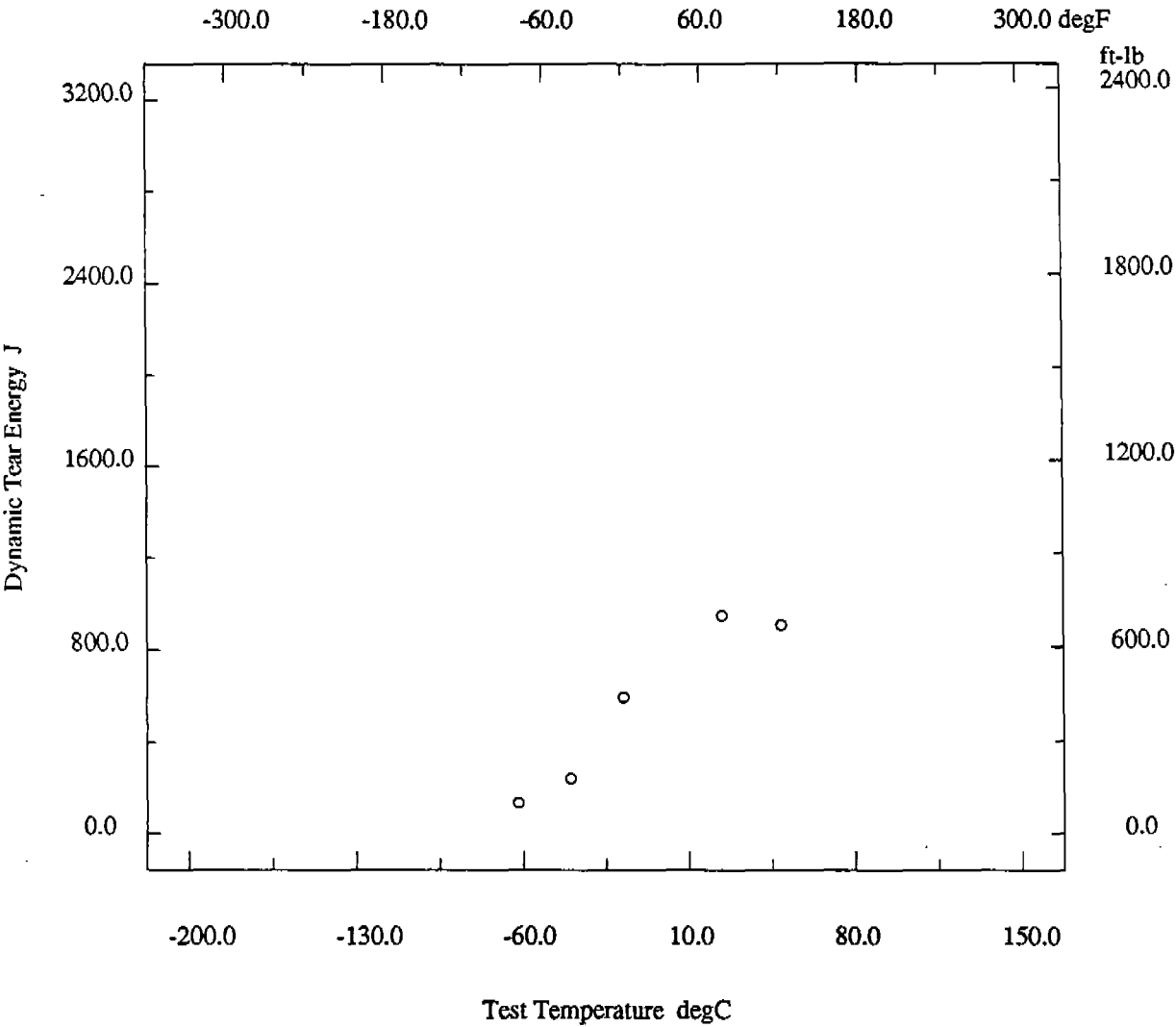
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Marine Structural Toughness Data Bank

Material CG A537M

Page 7200.12

Description			
Material Code	003.002.09.1	Material Name	CG A537M
UNS	*	Other Designation	Grade B
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	*		



* - not reported

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Manne Structural Toughness Data Bank

Material CG A537M

Page 7200.13

Description	
Material Code	003.002.03.1
Material Name	CG A537M
UNS	*
Other Designation	Grade B
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	*

Composition See Page 7200.1

Fabrication History See Page 7200.1

Weld	
Weld Code	003.002.03.1
Weld Type	SAW
Base Metal Thickness	1.0 in
Welding Position	Downhand
Preheat Temperature	150 degF
Metal Gap	0 in
Interpass Temperature	300 degF
Passes	*
Filler Specification	*
Filler Name	Armco W18
Filler Carbon Content	*
Filler Metal Size	5/32 in
Shielding Gas	*
Voltage	30 volts
Amperage	475 amps
Polarity	DCRP
Travel Speed	18 in/min
Heat Input/Pass	50 KJ/in
Joint Preparation	Double V-Groove
Number of Sides	2
Location wrt Weld	1mm in HAZ
Location wrt Surface	1/4T
Post-Weld Heat Temp	*
Post-Weld Heat Time	*
Flux Type	*
Flux Name	Linc 860
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	1/4T
Specimen Type	Full
Shear Fracture	*
Did Specimen Fracture?	*
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils
L-T ◦	-100	15.5	0.014
L-T ◦	-100	16.0	0.016
L-T ◦	-100	24.0	0.023
L-T ◦	-60	31.0	0.029
L-T ◦	-60	31.5	0.031
L-T ◦	-60	32.5	0.032
L-T ◦	-20	47.0	0.044
L-T ◦	-20	48.0	0.045
L-T ◦	-20	50.0	0.046
L-T ◦	32	50.0	0.049
L-T ◦	32	55.0	0.051
L-T ◦	32	56.5	0.052
L-T ◦	75	47.0	0.047
L-T ◦	75	48.5	0.050
L-T ◦	75	52.0	0.052

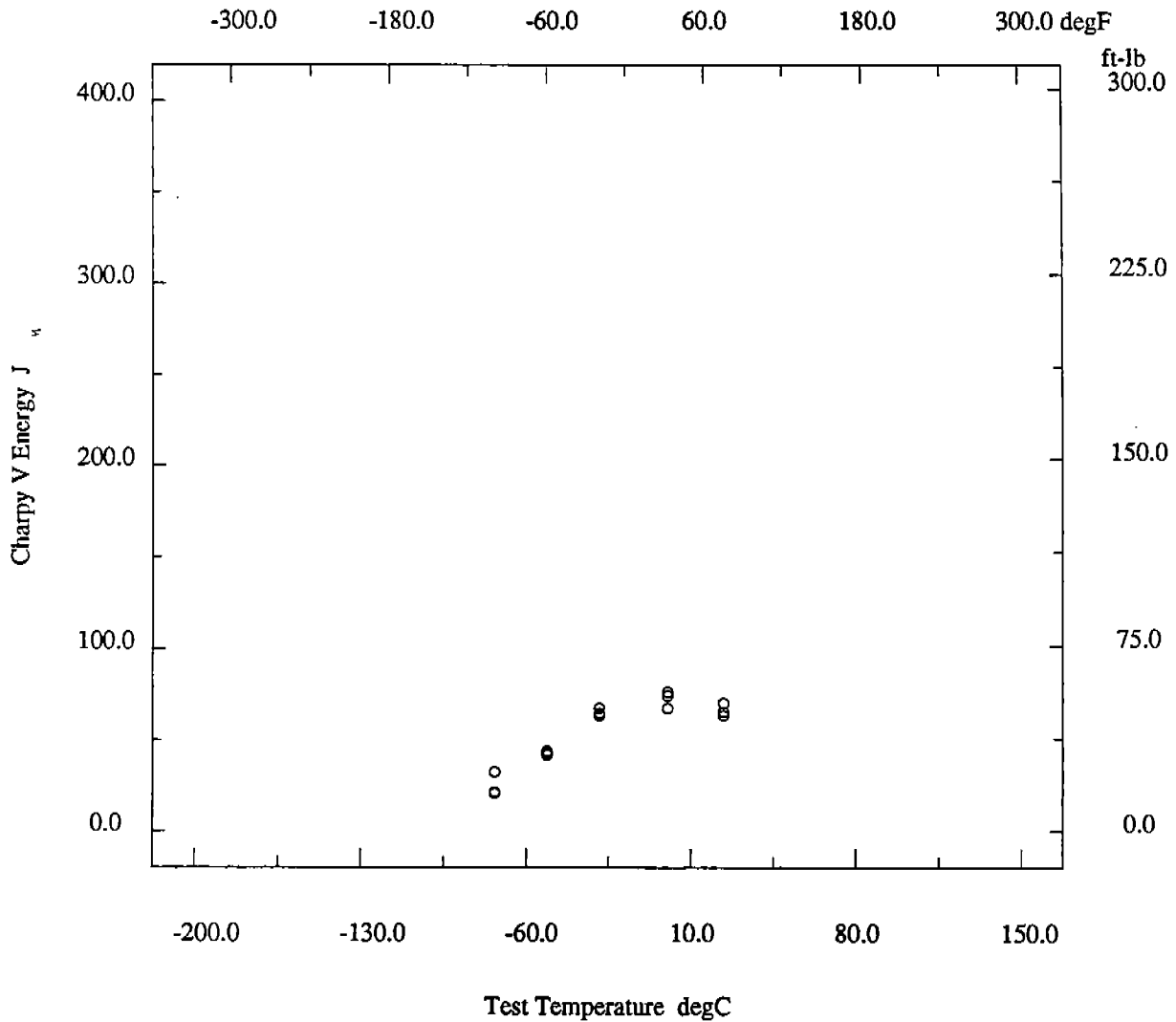
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Marine Structural Toughness Data Bank

Material CG A537M

Page 7200.14

Description				
Material Code	003.002.03.1	Material Name	CG A537M	
UNS	*	Other Designation	Grade B	
Type	Welded Joint	Form	Plate	
Thickness	1 in	Composition Type	Actual	
Composition Position	*	Lot ID	*	
Reference	*			



* - not reported

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Marine Structural Toughness Data Bank

Material CG A537M

Page 7200.15

Description			
Material Code	003.002.03.1	Material Name	CG A537M
UNS	*	Other Designation	Grade B
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	*		
Composition		See Page 7200.1	
Fabrication History		See Page 7200.1	
Weld		See Page 7200.13	
Property Measurements			
Test Type	Dynamic Tear	Position	0/4T
Specimen Type	Dynamic Tear	Notch Preparation	Pressed
Specimen Thickness	5/8 in	Loading Rate	*
Appearance	*	Standard Method	E 604
Standard Year	1976		

Orien	Test Temp degF	DT Energy ft-lb
L-T ◦	-80	65
L-T ◦	0	465
L-T ◦	75	550

* - not reported

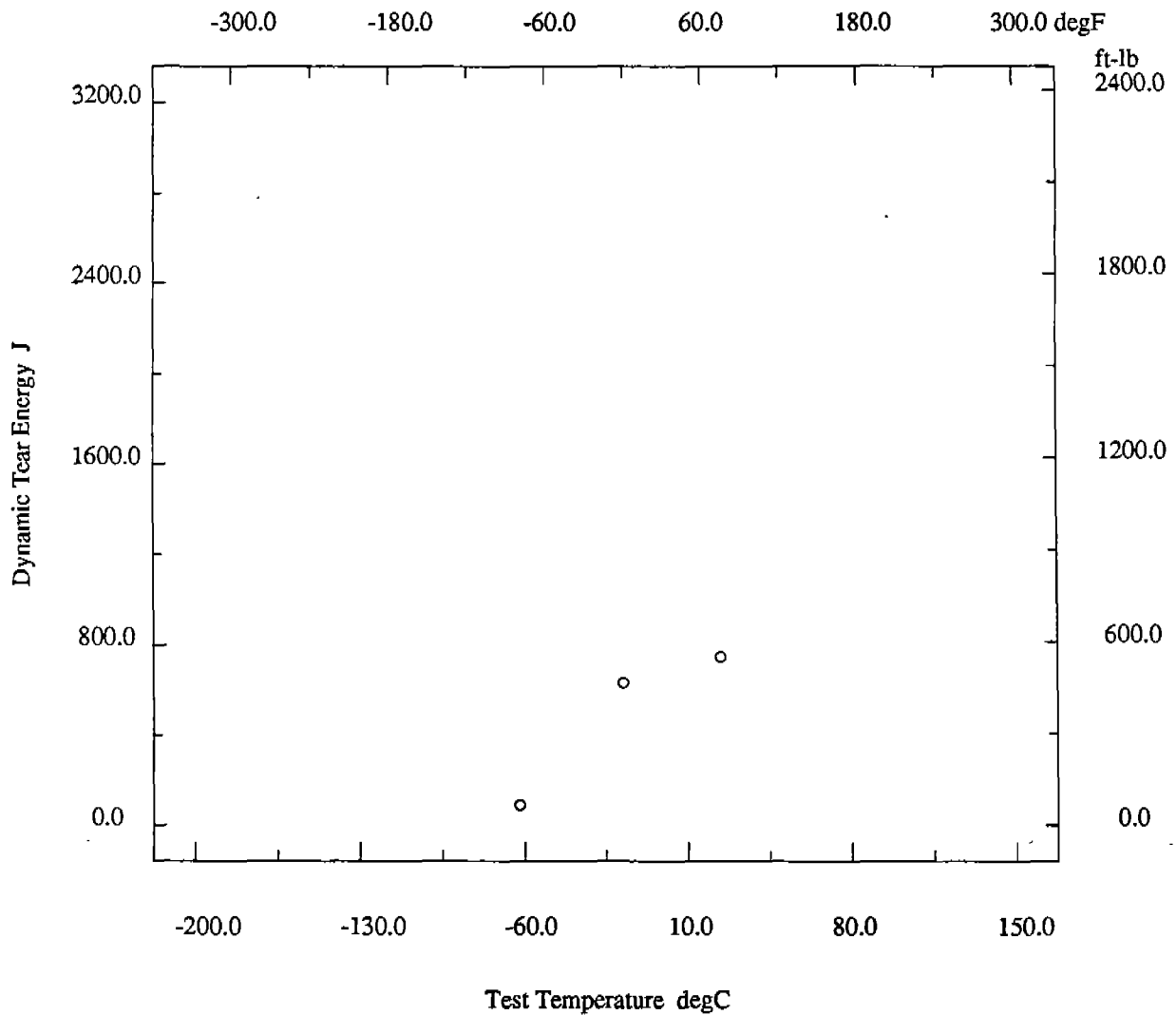


Marine Structural Toughness Data Bank

Material CG A537M

Page 7200.16

Description			
Material Code	003.002.03.1	Material Name	CG A537M
UNS	*	Other Designation	Grade B
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	*		



* - not reported

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Marine Structural Toughness Data Bank

Material A537 CL1

Page 7300.1

Description	
Material Code	003.003.01
Material Name	A537 CL1
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	3/4 in
Composition Type	Actual
Composition Position	*
Lot ID	D3791-2B
Reference	LR3201

Composition			
C	0.20 %	Mn	1.28 %
P	*	S	0.021 %
Si	*	Cr	*
Ni	*	Mo	0.07 %
V	*	Cu	*
Cb	*	Ti	*
B	*	Al	0.038 %
N	*	Other Components	None %

Fabrication History			
Heat Treatment	N	Producer	Lukens
Year Produced	1978	Addl Info	*
Source	Lukens	Melting Practice	*
Ingot Position	*	Killing Process	*
Process Temperature	*	Process Time	*
Rolling Conditions	*	Final Processing	N
Final Temperature	*	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Tensile	Position	1/4T
Specimen Type	Cylindrical	Specimen Thickness	0.252 in
Gage Length	1.0 in	Loading Rate	*
Tensile Strength Offset	*	Uniform Elongation	*
Tensile Modulus	*	Standard Method	*
Standard Year	*		

Orient	Test Temp degF	UTS ksi	TYS ksi	TYP ksi	Elongation %	RA %
L	80	83.7	54.2	54.2	27.8	63.1
L	80	84.2	52.4	53.6	28.0	62.2
T	80	84.2	55.9	62.0	27.3	61.7
T	80	84.2	56.3	61.2	28.5	63.6

* - not reported



Marine Structural Toughness Data Bank

Material A537 CL1

Page 7300.2

Description	
Material Code	003.003.01
Material Name	A537 CL1
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	3/4 in
Composition Type	Actual
Composition Position	*
Lot ID	D3791-2B
Reference	LR3201

Composition See Page 7300.1

Fabrication History See Page 7300.1

Property Measurements	
Test Type	Charpy V Impact
Position	1/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %	Split?
L-T ◯	-180	5	3	0	*
L-T ◯	-160	7	5	0	*
L-T ◯	-140	8	5	0	*
L-T ◯	-120	12	9	0	*
L-T ◯	-100	24	19	10	*
L-T ◯	-80	26	23	17	*
L-T ◯	-70	27	25	19	*
L-T ◯	-60	38	33	27	*
L-T ◯	-50	36	34	33	*
L-T ◯	-40	41	37	44	*
L-T ◯	-30	54	48	47	*
L-T ◯	-20	54	47	52	*
L-T ◯	-10	54	51	65	*
L-T ◯	0	68	57	72	*
L-T ◯	10	80	72	100	Yes
L-T ◯	20	80	70	100	*
L-T ◯	40	81	72	100	Yes
L-T ◯	60	86	74	100	*
L-T ◯	74	85	76	100	Yes
L-T ◯	100	81	70	100	Yes
T-L △	-180	4	3	0	*
T-L △	-160	7	5	0	*
T-L △	-140	10	6	0	*
T-L △	-120	12	10	0	*
T-L △	-100	13	13	6	*
T-L △	-80	16	15	11	*
T-L △	-70	19	20	15	*
T-L △	-60	23	23	27	*
T-L △	-50	21	23	30	*
T-L △	-40	23	26	40	*
T-L △	-30	27	29	47	*
T-L △	-20	33	34	60	*
T-L △	-10	34	36	52	*
T-L △	0	38	38	66	*
T-L △	10	41	41	75	Yes

* - not reported

(continued)



Marine Structural Toughness Data Bank

Material A537 CL1

Page 7300.3

(continued)

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %	Split?
T-L Δ	20	48	50	95	*
T-L Δ	40	49	49	99	*
T-L Δ	60	49	52	100	*
T-L Δ	74	48	49	100	*
T-L Δ	100	51	51	100	*

* - not reported

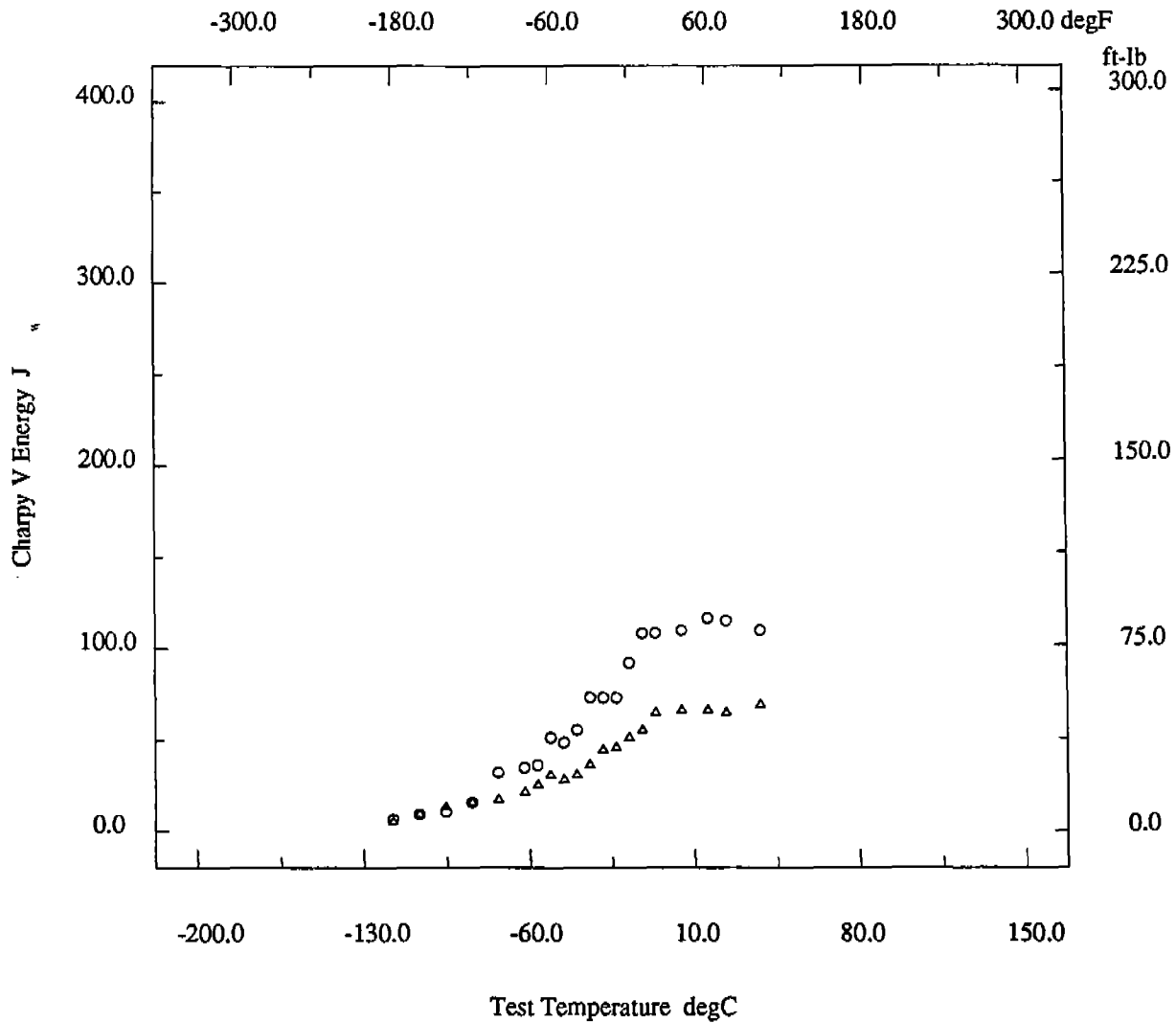


Marine Structural Toughness Data Bank

Material A537 CL1

Page 7300.4

Description	
Material Code	003.003.01
Material Name	A537 CL1
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	3/4 in
Composition Type	Actual
Composition Position	*
Lot ID	D3791-2B
Reference	LR3201



* - not reported

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Marine Structural Toughness Data Bank

Material A537 CL1

Page 7300.5

Description	
Material Code	003.003.01
Material Name	A537 CL1
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	3/4 in
Composition Type	Actual
Composition Position	*
Lot ID	D3791-2B
Reference	LR3201

Composition See Page 7300.1

Fabrication History See Page 7300.1

Property Measurements	
Test Type	Dynamic Tear
Position	1/2T
Specimen Type	Dynamic Tear
Notch Preparation	Pressed
Specimen Thickness	0.625 in
Loading Rate	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	DT Energy ft-lb	Frac Apear %
L-T ◯	-75	20	10
L-T ◯	-50	80	17
L-T ◯	-25	90	27
L-T ◯	0	185	45
L-T ◯	10	315	52
L-T ◯	25	440	71
L-T ◯	35	400	63
L-T ◯	50	720	98
L-T ◯	75	710	100
L-T ◯	100	740	100
T-L ▲	-75	20	10
T-L ▲	-50	65	20
T-L ▲	-25	85	25
T-L ▲	0	200	53
T-L ▲	10	230	55
T-L ▲	25	310	74
T-L ▲	35	410	95
T-L ▲	50	460	98
T-L ▲	75	440	100
T-L ▲	100	440	100

* - not reported

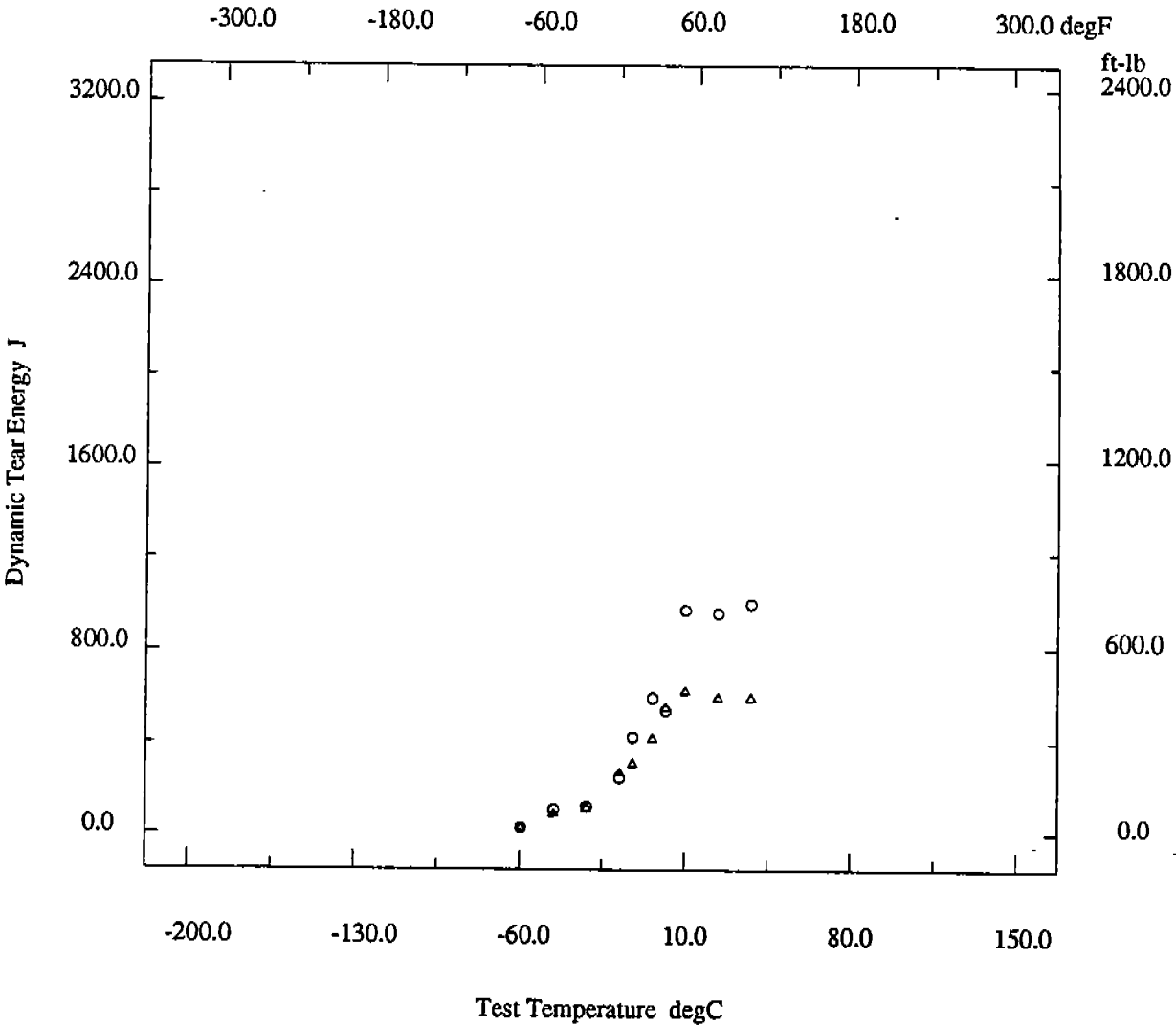


Marine Structural Toughness Data Bank

Material A537 CL1

Page 7300.6

Description			
Material Code	003.003.01	Material Name	A537 CL1
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	3/4 in	Composition Type	Actual
Composition Position	*	Lot ID	D3791-2B
Reference	LR3201		



* - not reported



Marine Structural Toughness Data Bank

Material A537 CL1

Page 7400.1

Description	
Material Code	013.004.010A
Material Name	A537 CL1
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition			
C	0.18 %	Mn	1.15 %
P	0.008 %	S	0.02 %
Si	0.29 %	Cr	0.09 %
Ni	0.22 %	Mo	0.04 %
V	<0.002 %	Cu	0.26 %
Cb	<0.005 %	Ti	*
B	*	Al	0.019 %
N	0.011 %	Other Components	None %

Fabrication History	
Heat Treatment	*
Producer	US Steel
Year Produced	*
Addl Info	*
Source	US Steel
Melting Practice	*
Ingot Position	*
Killing Process	Si-Al
Process Temperature	*
Process Time	*
Rolling Conditions	*
Final Processing	N
Final Temperature	*
Final Time	*
Cold Work Strain	*
Aging Temperature	*
Aging Time	*
Location	*

Property Measurements			
Test Type	Tensile	Position	1/4T
Specimen Type	Cylindrical	Specimen Thickness	0.357 in
Gage Length	1.4 in	Loading Rate	*
Tensile Strength Offset	0.2 %	Uniform Elongation	*
Tensile Modulus	*	Standard Method	*
Standard Year	*		

Orient	Test Temp degF	UTS ksi	TYS ksi	TYP ksi	Elongation %	RA %
*	Room	79.6	55.4	*	31.6	66.4

* - not reported



Matne Structural Toughness Data Bank

Material A537 CL1

Page 7400.2

Description	
Material Code	013.004.02AW
Material Name	A537 CL1
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 7400.1

Fabrication History See Page 7400.1

Weld	
Weld Code	013.004.02AW
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	Downhand IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	350 degF
Passes	15
Filler Specification	E8018-C3
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	*
Post-Weld Heat Time	*
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-125	10	6	20
L-T ◦	-125	11	8	25
L-T ◦	-100	17	13	35
L-T ◦	-100	20	14	30
L-T ◦	-100	8	6	25
L-T ◦	-75	23	17	45
L-T ◦	-75	25	20	50
L-T ◦	-50	42	34	80
L-T ◦	-50	52	39	75
L-T ◦	0	53	46	85
L-T ◦	0	60	48	90
L-T ◦	50	64	55	100
L-T ◦	50	65	58	100

* - not reported

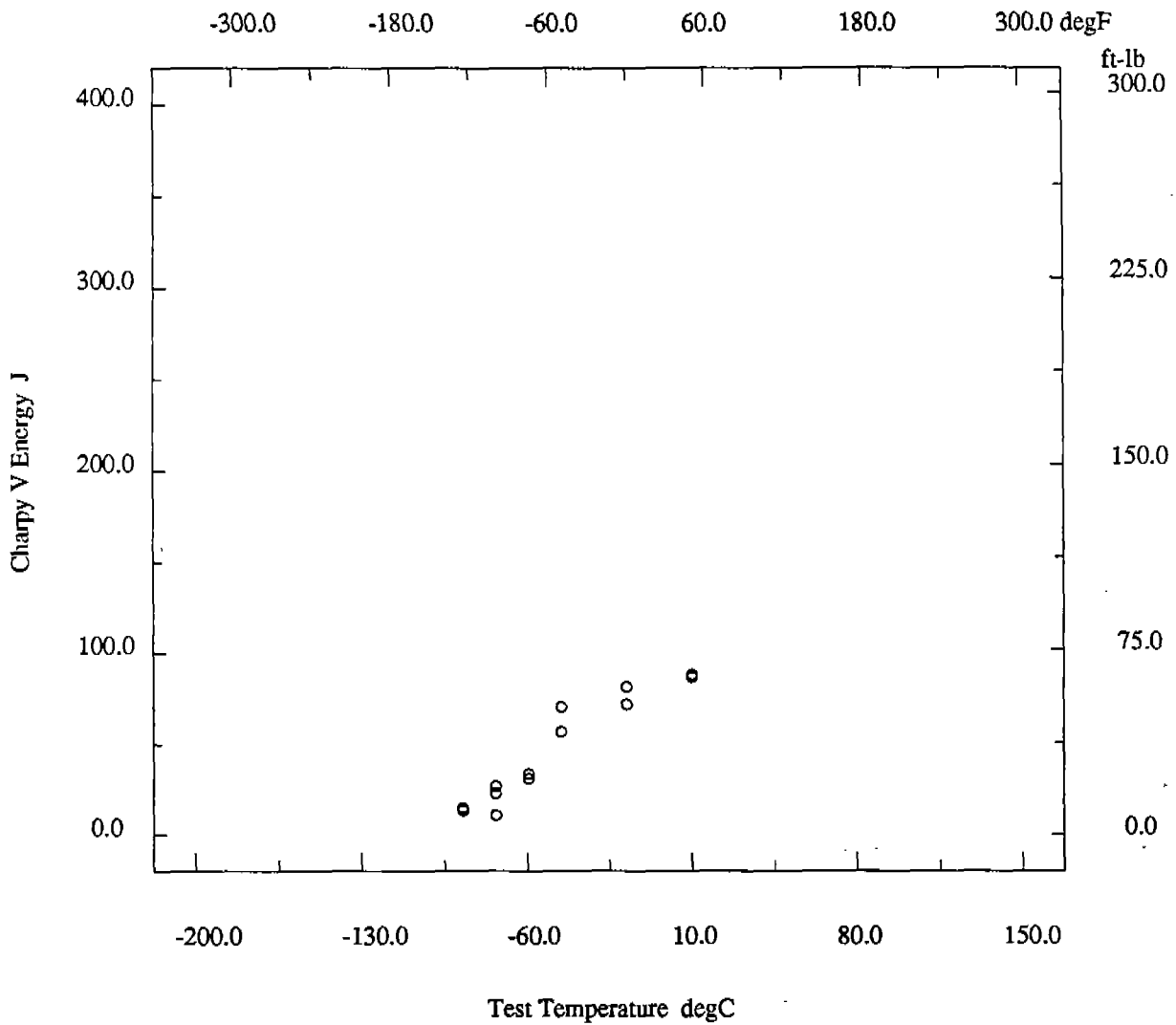


Marine Structural Toughness Data Bank

Material A537 CL1

Page 7400.3

Description			
Material Code	013.004.02AW	Material Name	A537 CL1
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported



Marine Structural Toughness Data Bank

Material A537 CL1

Page 7400.4

Description	
Material Code 013.004.02AS1	Material Name A537 CL1
UNS *	Other Designation *
Type Welded Joint	Form Plate
Thickness 1 in	Composition Type Actual
Composition Position *	Lot ID *
Reference KONKUL-1	
Composition	See Page 7400.1
Fabrication History	See Page 7400.1
Weld	
Weld Code 013.004.02AS1	Weld Type SMA
Base Metal Thickness 1 in	Welding Position Downhand IG
Preheat Temperature 50 degF	Metal Gap 0 in
Interpass Temperature 350 degF	Passes 15
Filler Specification E8018-C3	Filler Name *
Filler Carbon Content *	Filler Metal Size *
Shielding Gas *	Voltage *
Amperage *	Polarity *
Travel Speed *	Heat Input/Pass 34 KJ/in
Joint Preparation K-Groove	Number of Sides 2
Location wrt Weld Fusion line	Location wrt Surface Mid thickness at root
Post-Weld Heat Temp 1100 degF	Post-Weld Heat Time 1 hr
Flux Type *	Flux Name *
Weld Composition Reported? No	
Property Measurements	
Test Type Charpy V Impact	Position 3/4T
Specimen Type Full	Did Specimen Fracture? Assumed
Did Specimen Split? *	Standard Method *
Standard Year *	

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-150	10	5	25
L-T ◦	-150	7	4	20
L-T ◦	-125	11	8	30
L-T ◦	-125	12	9	20
L-T ◦	-100	18	10	40
L-T ◦	-100	26	20	35
L-T ◦	-75	20	17	35
L-T ◦	-75	39	33	75
L-T ◦	-50	55	42	85
L-T ◦	-50	60	58	100
L-T ◦	0	55	59	95
L-T ◦	0	58	58	100
L-T ◦	50	66	58	100
L-T ◦	50	70	54	98

* - not reported

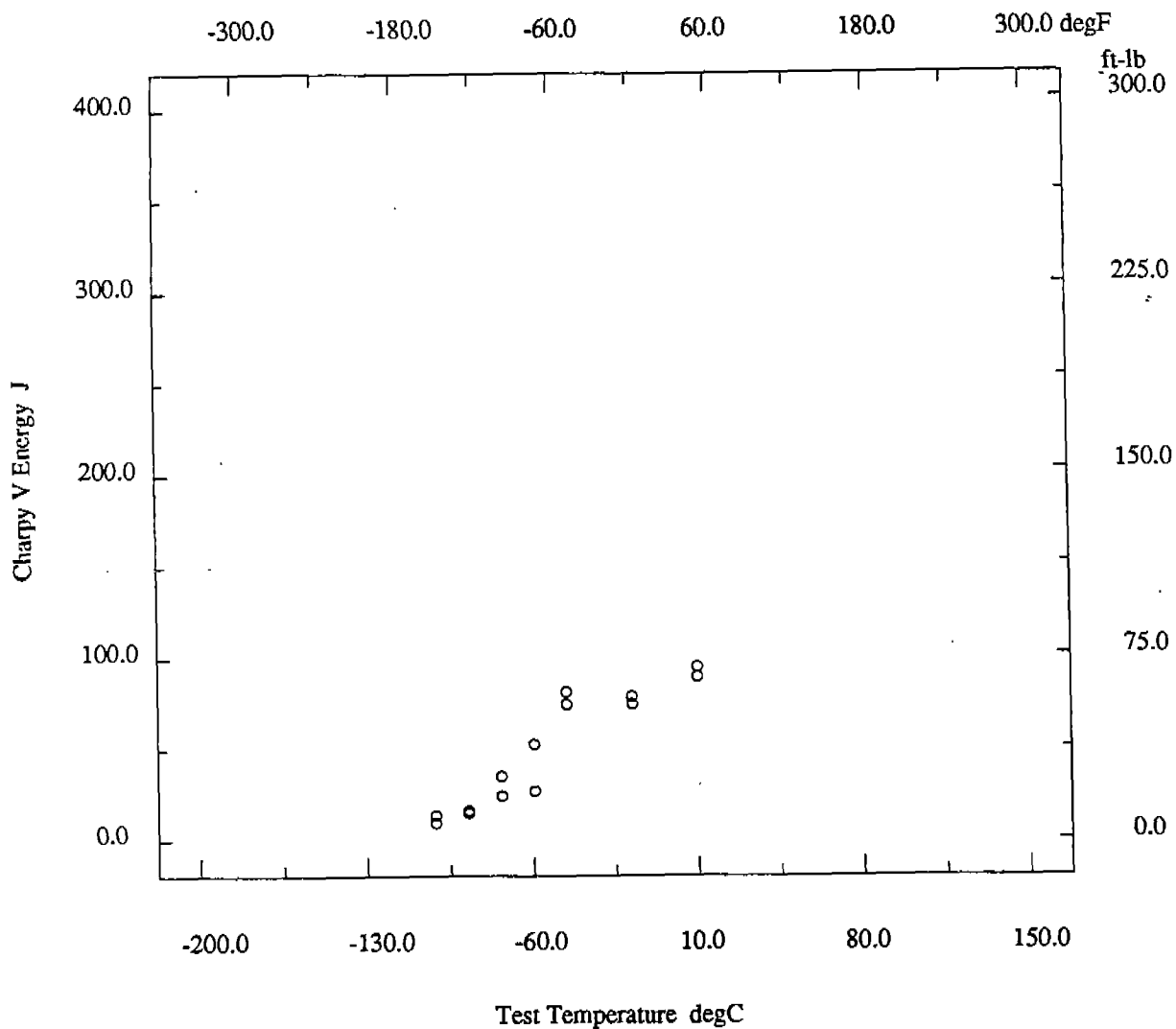


Marine Structural Toughness Data Bank

Material A537 CL1

Page 7400.5

Description			
Material Code	013.004.02AS1	Material Name	A537 CL1
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

Marine Structural Toughness Data Bank

Material A537 CL1

Page 7400.6

Description			
Material Code	013.004.02AS2	Material Name	A537 CL1
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		
Composition		See Page 7400.1	
Fabrication History		See Page 7400.1	
Weld			
Weld Code	013.004.02AS2	Weld Type	SMA
Base Metal Thickness	1 in	Welding Position	Downhand IG
Preheat Temperature	50 degF	Metal Gap	0 in
Interpass Temperature	350 degF	Passes	15
Filler Specification	E8018-C3	Filler Name	*
Filler Carbon Content	*	Filler Metal Size	*
Shielding Gas	*	Voltage	*
Amperage	*	Polarity	*
Travel Speed	*	Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove	Number of Sides	2
Location wrt Weld	Fusion line	Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	1100 degF	Post-Weld Heat Time	5 hr
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		
Property Measurements			
Test Type	Charpy V Impact	Position	3/4T
Specimen Type	Full	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T °	-150	5	3	15
L-T °	-150	6	4	20
L-T °	-125	20	16	20
L-T °	-125	25	22	65
L-T °	-125	28	22	35
L-T °	-100	19	14	45
L-T °	-100	25	24	75
L-T °	-75	35	27	70
L-T °	-75	36	33	70
L-T °	-50	35	29	65
L-T °	-50	35	33	70
L-T °	0	59	59	100
L-T °	0	62	59	100
L-T °	50	53	49	100
L-T °	50	59	56	99

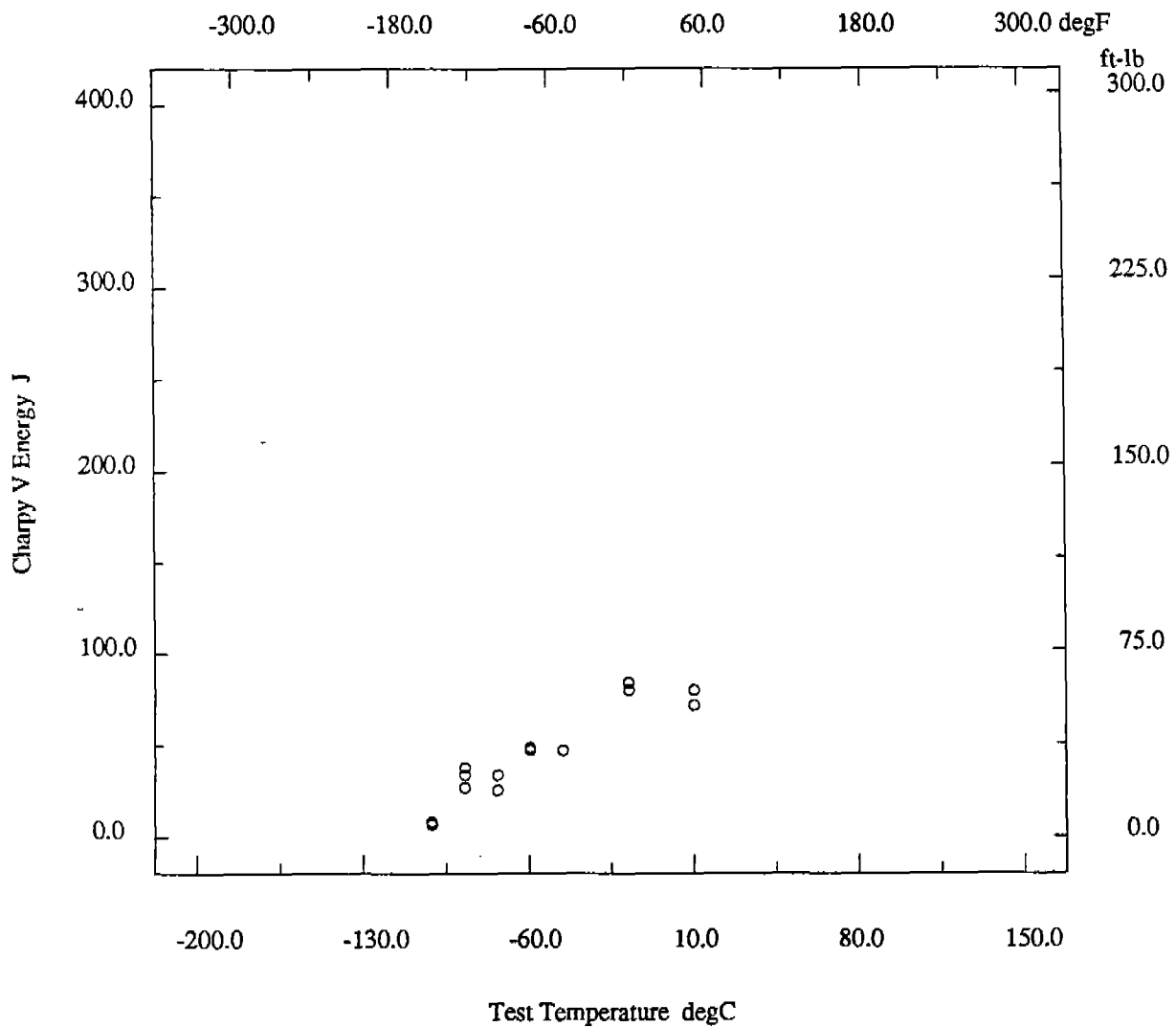
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Marine Structural Toughness Data Bank

Material A537 CL1

Page 7400.7

Description			
Material Code	013.004.02AS2	Material Name	A537 CL1
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported



Marine Structural Toughness Data Bank

Material A537 CL1

Page 7400.8

Description	
Material Code 013.004.02AS3	Material Name A537 CL1
UNS *	Other Designation *
Type Welded Joint	Form Plate
Thickness 1 in	Composition Type Actual
Composition Position *	Lot ID *
Reference KONKUL-1	
Composition	See Page 7400.1
Fabrication History	See Page 7400.1
Weld	
Weld Code 013.004.02AS3	Weld Type SMA
Base Metal Thickness 1 in	Welding Position Downhand IG
Preheat Temperature 50 degF	Metal Gap 0 in
Interpass Temperature 350 degF	Passes 15
Filler Specification E8018-C3	Filler Name *
Filler Carbon Content *	Filler Metal Size *
Shielding Gas *	Voltage *
Amperage *	Polarity *
Travel Speed *	Heat Input/Pass 34 KJ/in
Joint Preparation K-Groove	Number of Sides 2
Location wrt Weld Fusion line	Location wrt Surface Mid thickness at root
Post-Weld Heat Temp 1200 degF	Post-Weld Heat Time 1 hr
Flux Type *	Flux Name *
Weld Composition Reported? No	
Property Measurements	
Test Type Charpy V Impact	Position 3/4T
Specimen Type Full	Did Specimen Fracture? Assumed
Did Specimen Split? *	Standard Method *
Standard Year *	

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-125	11	9	25
L-T ◦	-125	21	19	35
L-T ◦	-125	21	20	30
L-T ◦	-100	10	9	25
L-T ◦	-100	13	14	25
L-T ◦	-100	15	16	25
L-T ◦	-75	26	25	70
L-T ◦	-75	44	40	70
L-T ◦	-50	35	36	70
L-T ◦	-50	55	52	80
L-T ◦	0	53	54	98
L-T ◦	0	62	58	100
L-T ◦	50	62	54	100
L-T ◦	50	70	68	100

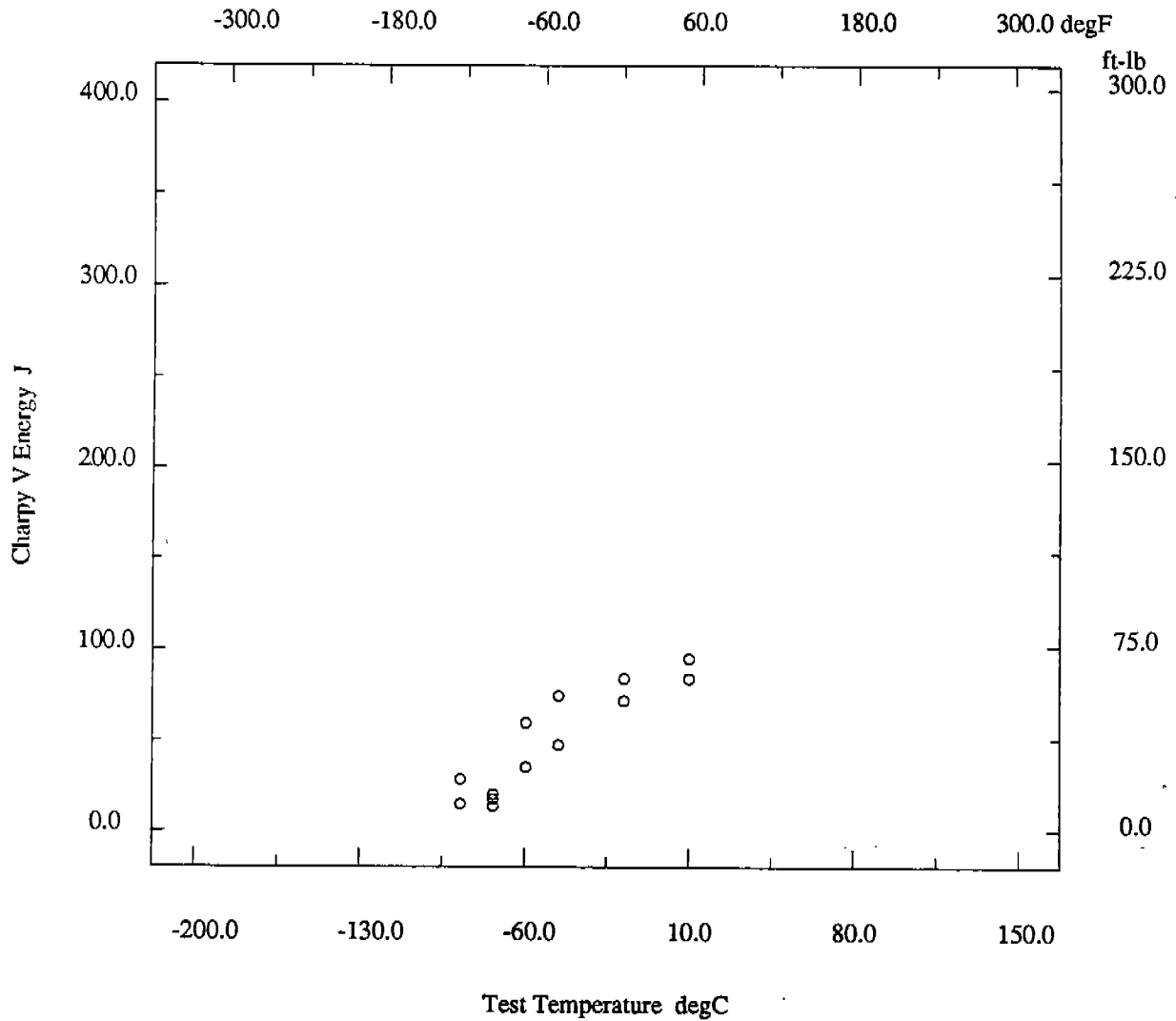
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Marine Structural Toughness Data Bank

Material A537 CL1

Page 7400.9

Description			
Material Code	013.004.02AS3	Material Name	A537 CL1
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported



Marine Structural Toughness Data Bank

Material A537 CL1

Page 7400.10

Description		
Material Code	013.004.02AS4	Material Name A537 CL1
UNS	*	Other Designation *
Type	Welded Joint	Form Plate
Thickness	1 in	Composition Type Actual
Composition Position	*	Lot ID *
Reference	KONKUL-1	
Composition		See Page 7400.1
Fabrication History		See Page 7400.1
Weld		
Weld Code	013.004.02AS4	Weld Type SMA
Base Metal Thickness	1 in	Welding Position Downhand IG
Preheat Temperature	50 degF	Metal Gap 0 in
Interpass Temperature	350 degF	Passes 15
Filler Specification	E8018-C3	Filler Name *
Filler Carbon Content	*	Filler Metal Size *
Shielding Gas	*	Voltage *
Amperage	*	Polarity *
Travel Speed	*	Heat Input/Pass 34 KJ/in
Joint Preparation	K-Groove	Number of Sides 2
Location wrt Weld	Fusion line	Location wrt Surface Mid thickness at root
Post-Weld Heat Temp	1200 degF	Post-Weld Heat Time 5 hr
Flux Type	*	Flux Name *
Weld Composition Reported?	No	
Property Measurements		
Test Type	Charpy V Impact	Position 3/4T
Specimen Type	Full	Did Specimen Fracture? Assumed
Did Specimen Split?	*	Standard Method *
Standard Year	*	

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-150	13	14	15
L-T ◦	-150	7	6	5
L-T ◦	-125	15	18	40
L-T ◦	-125	17	22	25
L-T ◦	-100	16	22	45
L-T ◦	-100	23	27	40
L-T ◦	-75	23	26	45
L-T ◦	-75	49	37	70
L-T ◦	-75	51	48	100
L-T ◦	-50	45	44	80
L-T ◦	-50	47	44	75
L-T ◦	0	62	59	100
L-T ◦	0	65	60	100
L-T ◦	50	50	49	100
L-T ◦	50	66	59	100

* - not reported

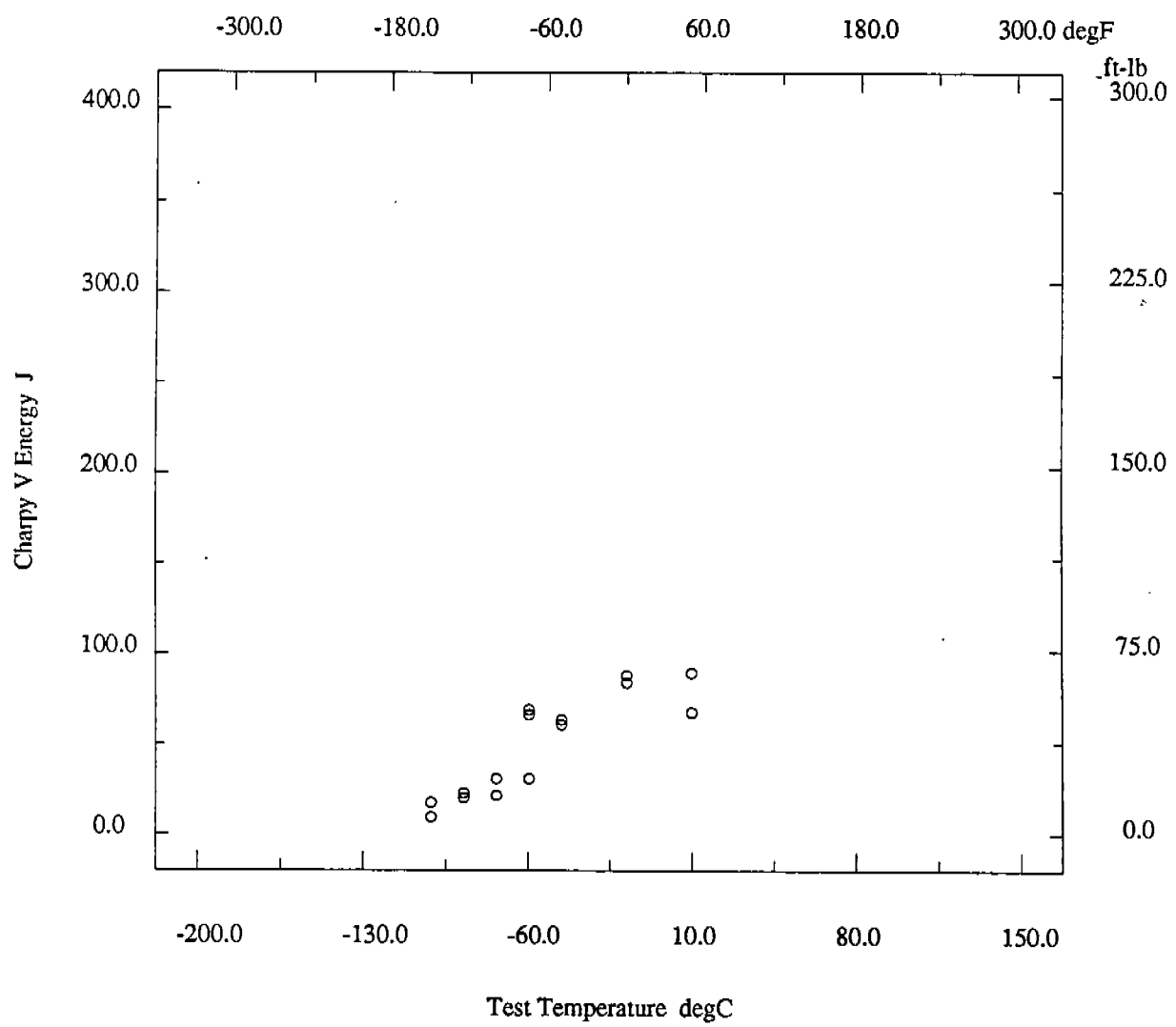


Marine Structural Toughness Data Bank

Material A537 CL1

Page 7400.11

Description			
Material Code	013.004.02AS4	Material Name	A537 CL1
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.1

Description						
Material Code	016.001.010A	Material Name	A572 Gr50			
UNS	*	Other Designation	*			
Type	Wrought Metal	Form	Plate			
Thickness	1 in	Composition Type	Actual			
Composition Position	*	Lot ID	*			
Reference	KONKUL-1					
Composition						
C	0.20 %	Mn	1.24 %			
P	0.004 %	S	0.024 %			
Si	0.02 %	Cr	0.02 %			
Ni	0.04 %	Mo	0.01 %			
V	0.089 %	Cu	0.04 %			
Cb	<0.005 %	Ti	*			
B	*	Al	<0.002 %			
N	0.005 %	Other Components	*			
Fabrication History						
Heat Treatment	*	Producer	US Steel			
Year Produced	*	Addl Info	*			
Source	US Steel	Melting Practice	*			
Ingot Position	*	Killing Process	*			
Process Temperature	*	Process Time	*			
Rolling Conditions	*	Final Processing	A,R			
Final Temperature	*	Final Time	*			
Cold Work Strain	*	Aging Temperature	*			
Aging Time	*	Location	*			
Property Measurements						
Test Type	Tensile	Position	1/4T			
Specimen Type	Cylindrical	Specimen Thickness	0.357 in			
Gage Length	1.4 in	Loading Rate	*			
Tensile Strength Offset	0.2 %	Uniform Elongation	*			
Tensile Modulus	*	Standard Method	*			
Standard Year	*					
Orient	Test Temp	UTS	TYS	TYP	Elongation	RA
	degF	ksi	ksi	ksi	%	%
L	Room	87.9	58.7	*	26.9	66

* - not reported

Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.2

Description	
Material Code	016.001.09AA
Material Name	A572 Gr50
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 7600.1

Fabrication History See Page 7600.1

Weld	
Weld Code	016.001.09AA
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	350 degF
Passes	16
Filler Specification	E7018
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	11mm in HAZ
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	*
Post-Weld Heat Time	*
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-75	10	11	10
L-T ◦	-75	14	11	10
L-T ◦	-50	10	12	15
L-T ◦	-50	29	23	10
L-T ◦	-25	15	19	30
L-T ◦	-25	20	23	30
L-T ◦	0	30	30	40
L-T ◦	0	70	58	40
L-T ◦	25	62	56	50
L-T ◦	25	83	70	60
L-T ◦	50	102	82	75
L-T ◦	50	68	58	60
L-T ◦	75	109	93	90
L-T ◦	75	110	89	80

* - not reported

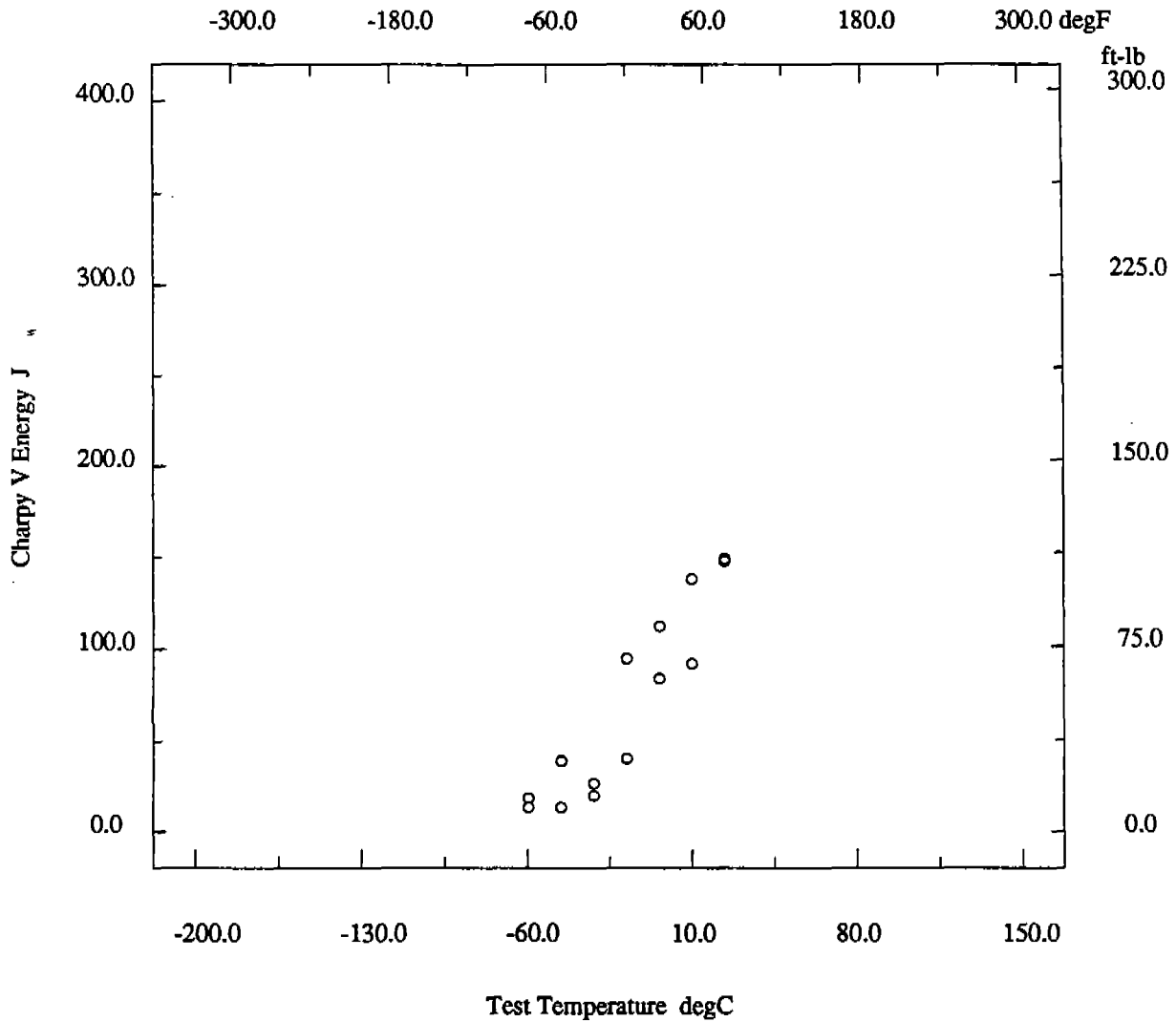


Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.3

Description			
Material Code	016.001.09AA	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.4

Description	
Material Code	016.001.02AA
Material Name	A572 Gr50
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 7600.1

Fabrication History See Page 7600.1

Weld	
Weld Code	016.001.02AA
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	350 degF
Passes	16
Filler Specification	E7018
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	*
Post-Weld Heat Time	*
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-100	29	18	20
L-T ◦	-100	5	3	10
L-T ◦	-75	75	46	30
L-T ◦	-75	8	7	10
L-T ◦	-50	33	25	30
L-T ◦	-50	8	10	15
L-T ◦	-25	121	75	40
L-T ◦	-25	124	80	50
L-T ◦	0	103	79	65
L-T ◦	0	45	39	55
L-T ◦	25	63	54	50
L-T ◦	25	81	65	75
L-T ◦	50	65	51	60
L-T ◦	50	90	73	90

* - not reported

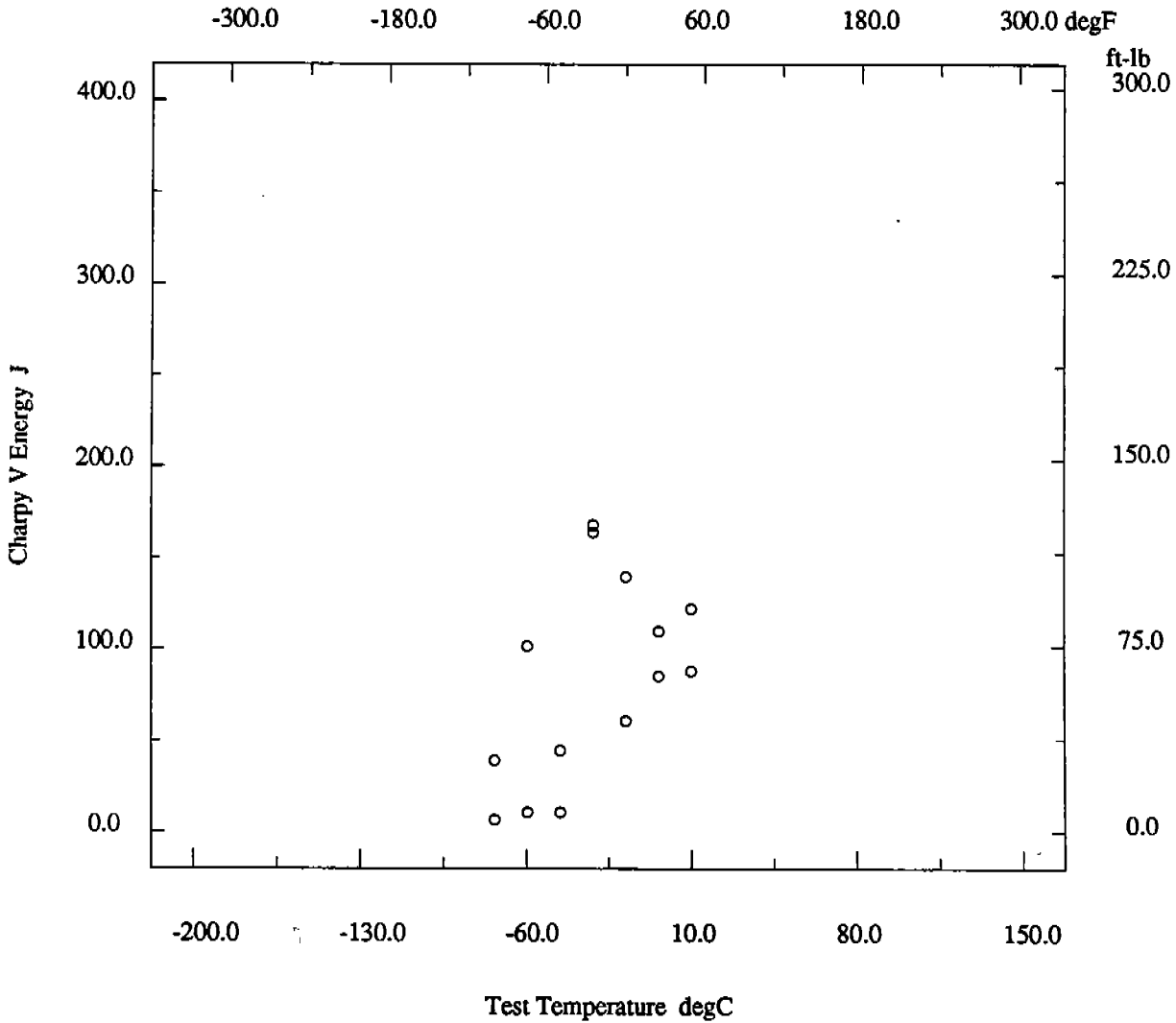


Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.5

Description					
Material Code	016.001.02AA	Material Name	.....	A572 Gr50
UNS	*	Other Designation	.....	*
Type	Welded Joint	Form	.....	Plate
Thickness	1 in	Composition Type	.....	Actual
Composition Position	*	Lot ID	.....	*
Reference	KONKUL-1			



* - not reported

(15)

Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.6

Description	
Material Code	016.001.09AS1
Material Name	A572 Gr50
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 7600.1

Fabrication History See Page 7600.1

Weld	
Weld Code	016.001.09AS1
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	350 degF
Passes	16
Filler Specification	E7018
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	11mm in HAZ
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	1100 degF
Post-Weld Heat Time	1 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-100	6	6	10
L-T ◦	-100	9	10	10
L-T ◦	-75	11	11	10
L-T ◦	-75	28	24	15
L-T ◦	-50	61	54	30
L-T ◦	-50	65	54	30
L-T ◦	-25	74	66	40
L-T ◦	-25	92	87	50
L-T ◦	0	82	67	60
L-T ◦	0	95	88	65
L-T ◦	25	121	90	70
L-T ◦	25	91	76	70
L-T ◦	50	112	92	85
L-T ◦	50	116	96	90

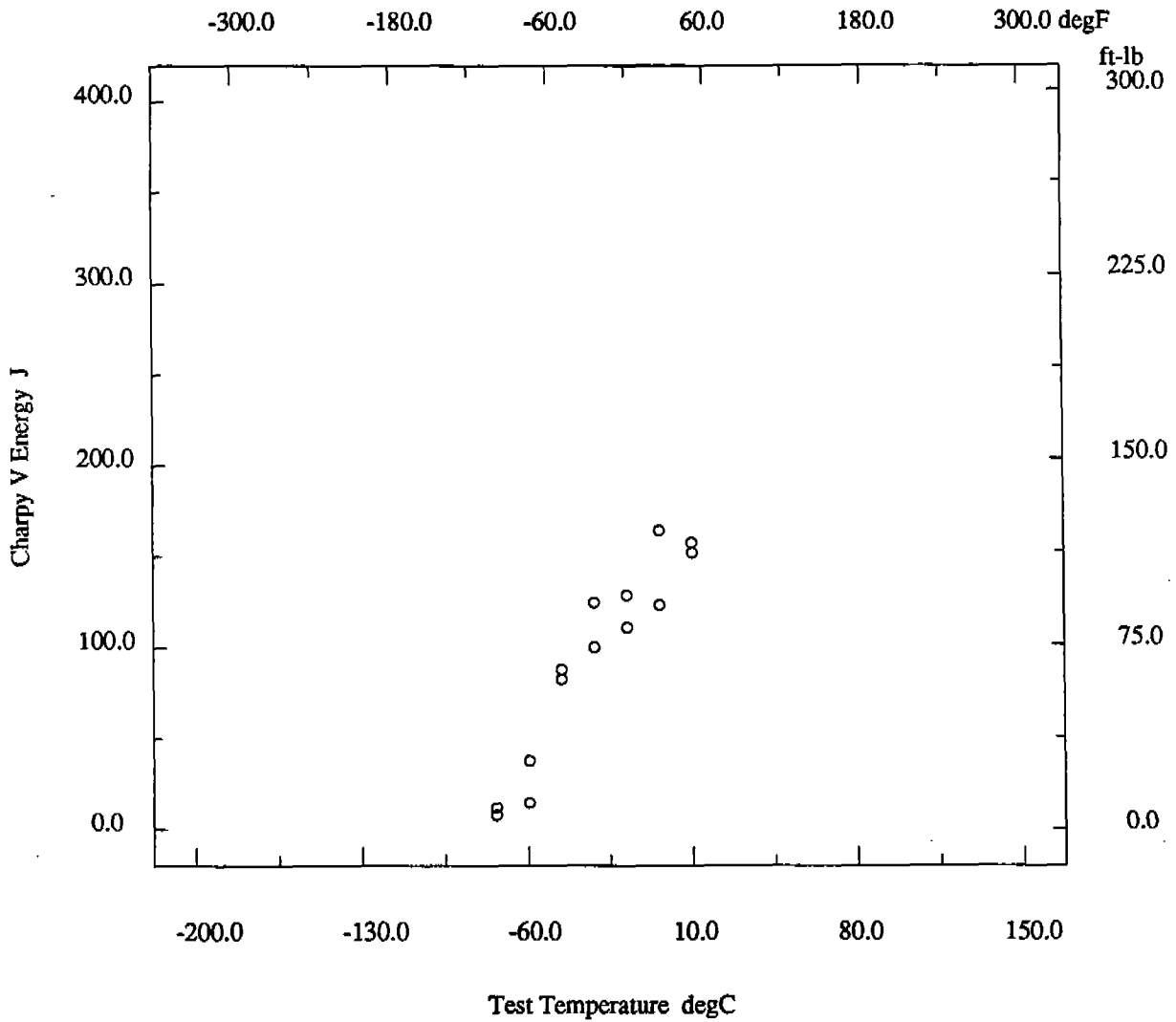
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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.7

Description			
Material Code	016.001.09AS1	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.8

Description	
Material Code	016.001.02AS1
Material Name	A572 Gr50
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 7600.1

Fabrication History See Page 7600.1

Weld	
Weld Code	016.001.02AS1
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	350 degF
Passes	16
Filler Specification	E7018
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	1100 degF
Post-Weld Heat Time	1 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-100	50	33	30
L-T ◦	-100	6	4	10
L-T ◦	-75	10	7	10
L-T ◦	-75	25	16	30
L-T ◦	-50	10	13	30
L-T ◦	-50	30	26	20
L-T ◦	-25	7	9	20
L-T ◦	-25	93	66	40
L-T ◦	0	14	13	25
L-T ◦	0	90	63	50
L-T ◦	25	25	20	20
L-T ◦	25	73	57	60
L-T ◦	50	123	92	98
L-T ◦	50	137	88	98

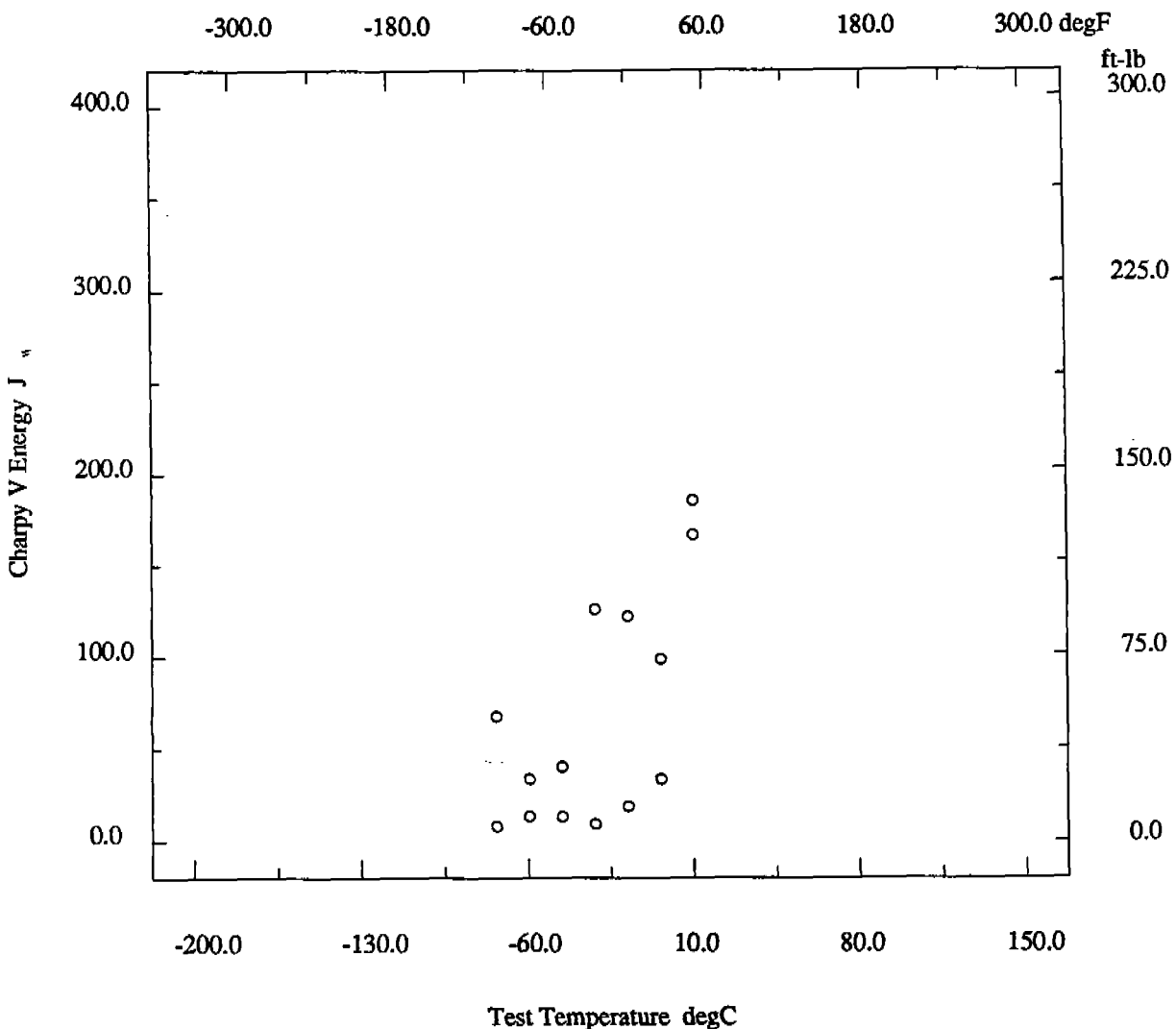
* - not reported

Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.9

Description		Material Name
Material Code	016.001.02AS1	A572 Gr50
UNS	*	Other Designation
Type	Welded Joint	Form
Thickness	1 in	Composition Type
Composition Position	*	Lot ID
Reference	KONKUL-1	



* - not reported

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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.10

Description			
Material Code	016.001.09AS2	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		
Composition		See Page 7600.1	
Fabrication History		See Page 7600.1	
Weld			
Weld Code	016.001.09AS2	Weld Type	SMA
Base Metal Thickness	1 in	Welding Position	IG
Preheat Temperature	50 degF	Metal Gap	0 in
Interpass Temperature	350 degF	Passes	16
Filler Specification	E7018	Filler Name	*
Filler Carbon Content	*	Filler Metal Size	*
Shielding Gas	*	Voltage	*
Amperage	*	Polarity	*
Travel Speed	*	Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove	Number of Sides	2
Location wrt Weld	11mm in HAZ	Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	1100 degF	Post-Weld Heat Time	5 hr
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		
Property Measurements			
Test Type	Charpy V Impact	Position	3/4T
Specimen Type	Full	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-75	10	12	15
L-T ◦	-75	7	13	10
L-T ◦	-50	10	19	15
L-T ◦	-50	14	17	20
L-T ◦	-50	50	42	25
L-T ◦	-25	51	49	80
L-T ◦	-25	79	67	65
L-T ◦	0	91	75	65
L-T ◦	0	96	81	60
L-T ◦	25	100	82	70
L-T ◦	25	107	80	65
L-T ◦	50	100	87	80
L-T ◦	50	111	92	80
L-T ◦	75	120	94	100

* - not reported

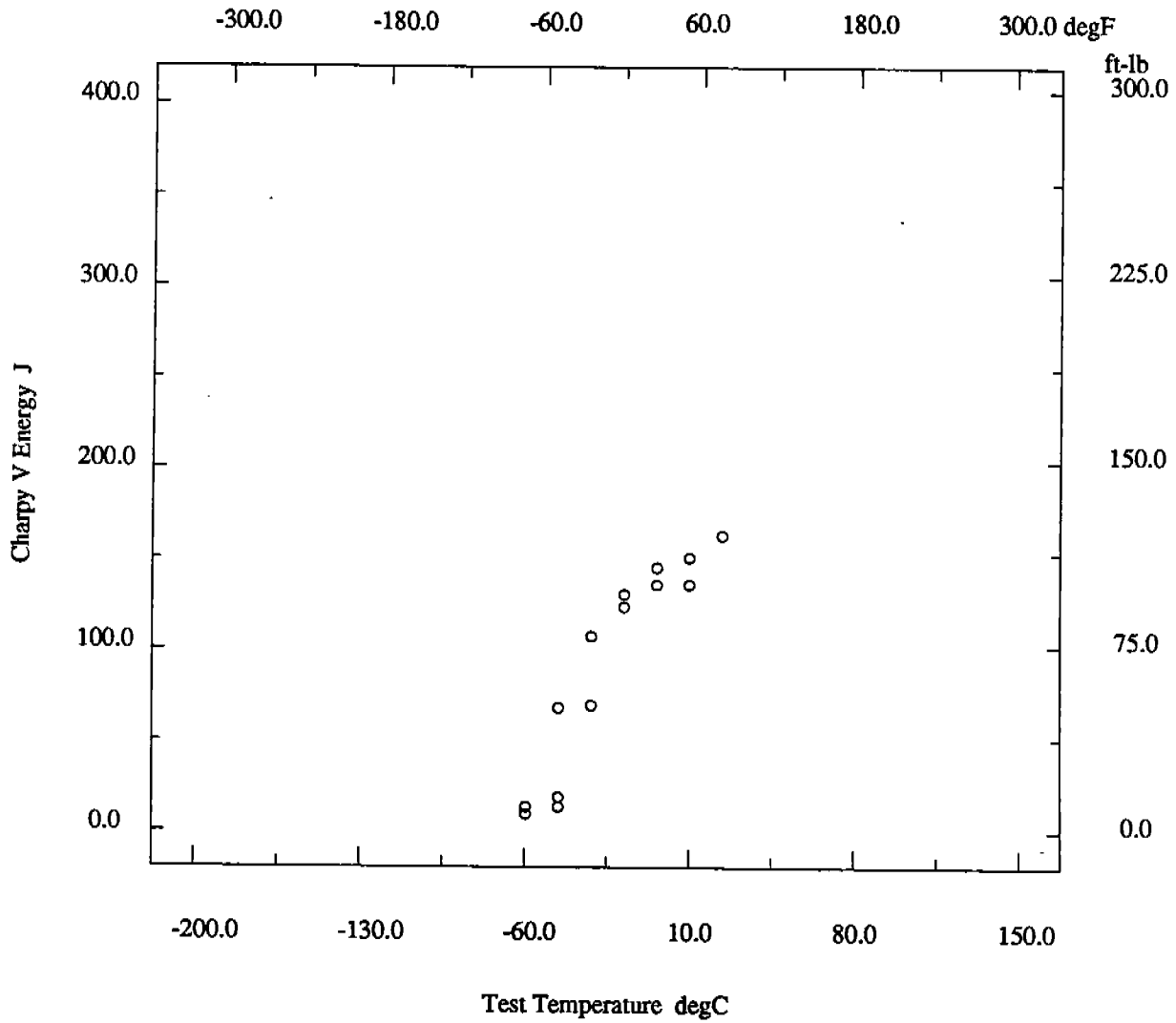
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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.11

Description			
Material Code	016.001.09AS2	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.12

Description	
Material Code 016.001.02AS2	Material Name A572 Gr50
UNS *	Other Designation *
Type Welded Joint	Form Plate
Thickness 1 in	Composition Type Actual
Composition Position *	Lot ID *
Reference KONKUL-1	

Composition	See Page 7600.1
--------------------	-----------------

Fabrication History	See Page 7600.1
----------------------------	-----------------

Weld	
Weld Code 016.001.02AS2	Weld Type SMA
Base Metal Thickness 1 in	Welding Position IG
Preheat Temperature 50 degF	Metal Gap 0 in
Interpass Temperature 350 degF	Passes 16
Filler Specification E7018	Filler Name *
Filler Carbon Content *	Filler Metal Size *
Shielding Gas *	Voltage *
Amperage *	Polarity *
Travel Speed *	Heat Input/Pass 34 KJ/in
Joint Preparation K-Groove	Number of Sides 2
Location wrt Weld Fusion line	Location wrt Surface Mid thickness at root
Post-Weld Heat Temp 1100 degF	Post-Weld Heat Time 5 hr
Flux Type *	Flux Name *
Weld Composition Reported? No	

Property Measurements	
Test Type Charpy V Impact	Position 3/4T
Specimen Type Full	Did Specimen Fracture? Assumed
Did Specimen Split? *	Standard Method *
Standard Year *	

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T °	-50	5	4	5
L-T °	-50	5	7	10
L-T °	-25	19	22	35
L-T °	-25	35	35	55
L-T °	-25	7	10	25
L-T °	0	24	25	60
L-T °	0	60	47	45
L-T °	25	70	55	40
L-T °	25	80	57	35
L-T °	50	40	38	65
L-T °	50	48	49	70
L-T °	75	25	29	40
L-T °	100	100	72	90
L-T °	100	95	68	90

* - not reported

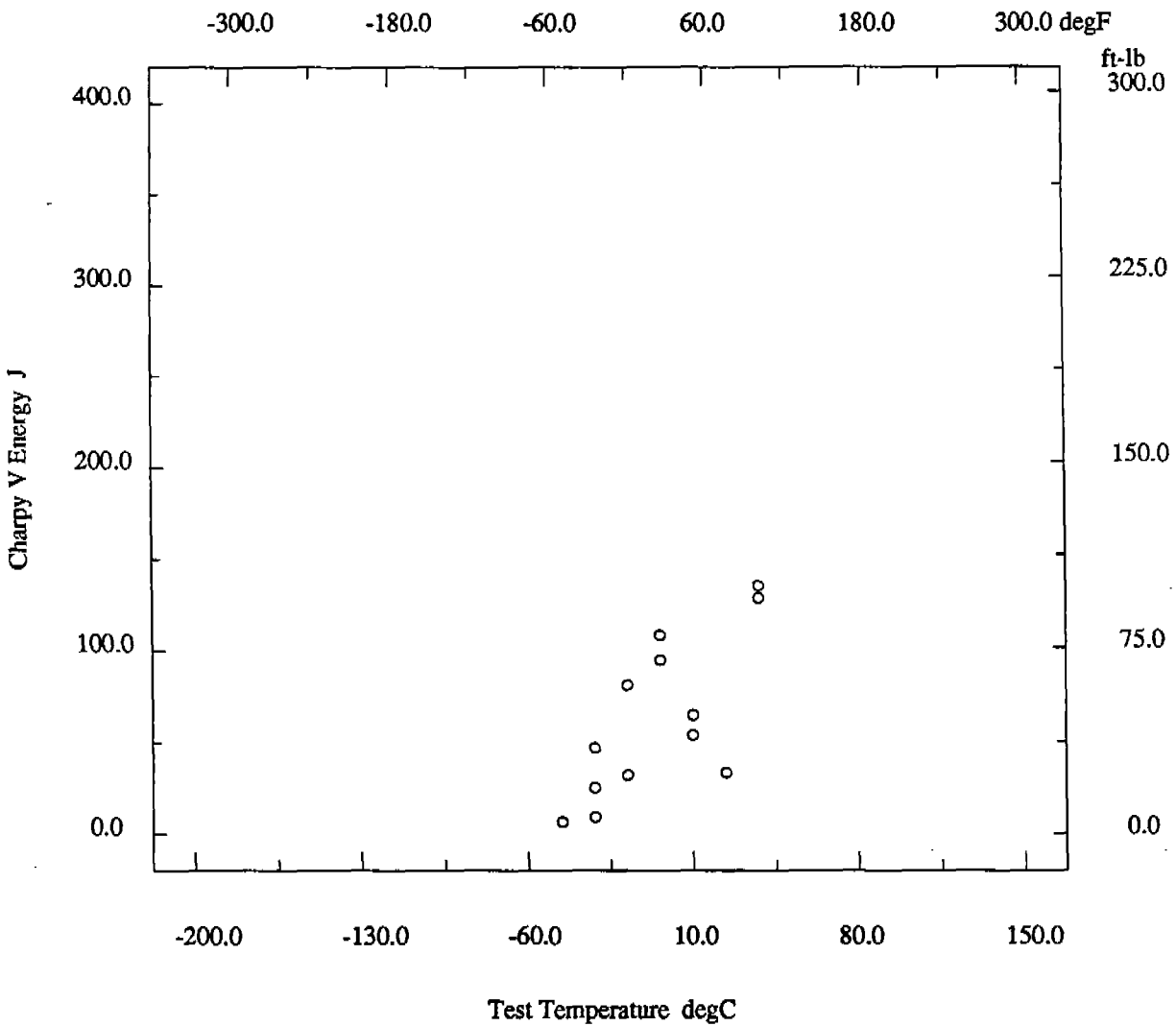
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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.13

Description			
Material Code	016.001.02AS2	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

(h)

Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.14

Description			
Material Code	016.001.09AS3	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		
Composition		See Page 7600.1	
Fabrication History		See Page 7600.1	
Weld			
Weld Code	016.001.09AS3	Weld Type	SMA
Base Metal Thickness	1 in	Welding Position	IG
Preheat Temperature	50 degF	Metal Gap	0 in
Interpass Temperature	350 degF	Passes	16
Filler Specification	E7018	Filler Name	*
Filler Carbon Content	*	Filler Metal Size	*
Shielding Gas	*	Voltage	*
Amperage	*	Polarity	*
Travel Speed	*	Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove	Number of Sides	2
Location wrt Weld	11mm in HAZ	Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	1200 degF	Post-Weld Heat Time	1 hr
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		
Property Measurements			
Test Type	Charpy V Impact	Position	3/4T
Specimen Type	Full	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-75	10	6	5
L-T ◦	-75	11	9	10
L-T ◦	-50	25	22	20
L-T ◦	-50	25	24	20
L-T ◦	-25	13	22	15
L-T ◦	-25	56	48	30
L-T ◦	-25	60	54	35
L-T ◦	0	35	40	40
L-T ◦	0	36	39	40
L-T ◦	25	30	35	45
L-T ◦	25	83	69	60
L-T ◦	50	84	68	60
L-T ◦	50	86	75	65
L-T ◦	100	115	93	100

* - not reported

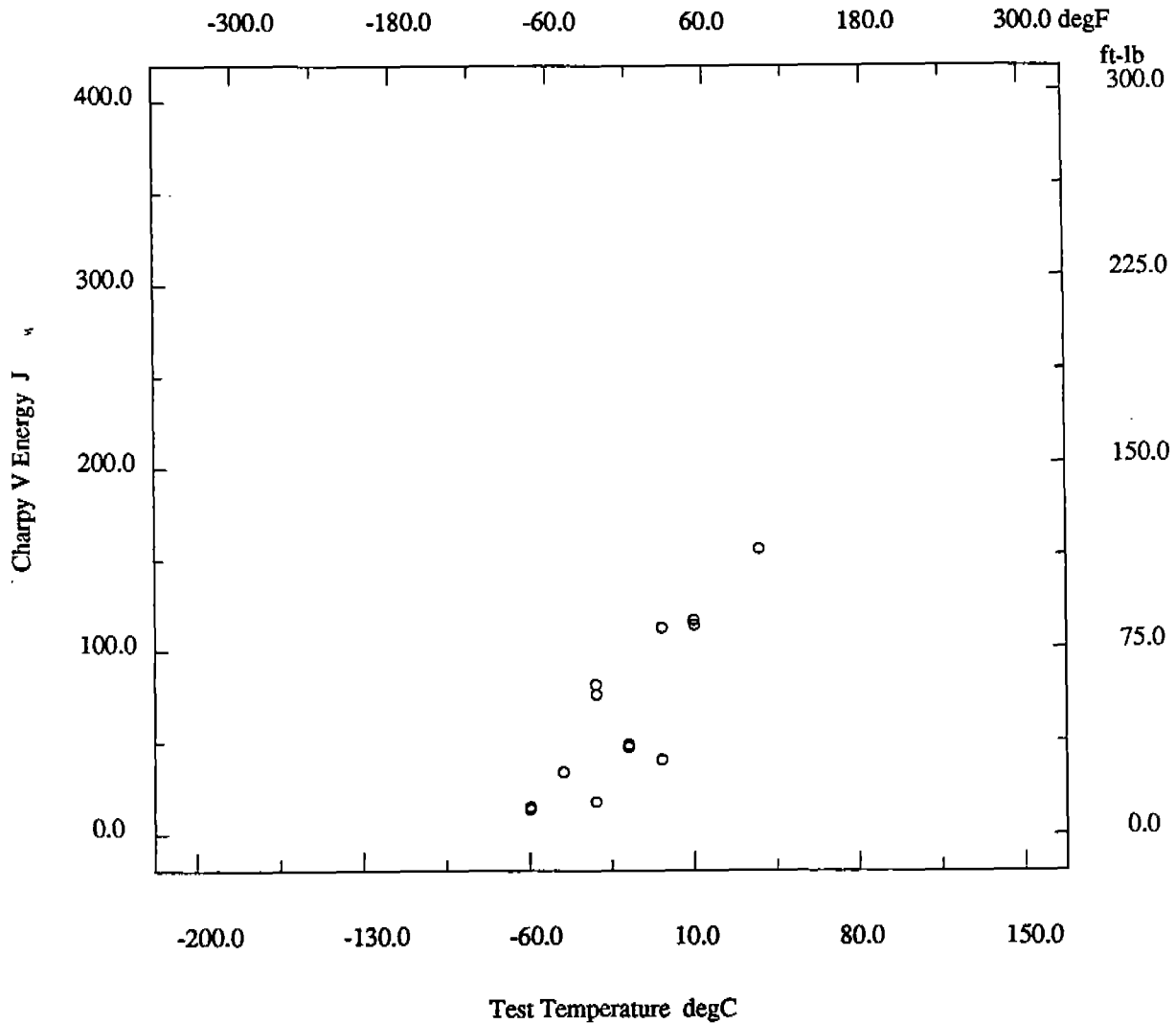
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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.15

Description				
Material Code	016.001.09AS3	Material Name	A572 Gr50	
UNS	*	Other Designation	*	
Type	Welded Joint	Form	Plate	
Thickness	1 in	Composition Type	Actual	
Composition Position	*	Lot ID	*	
Reference	KONKUL-1			



* - not reported

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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.16

Description	
Material Code	016.001.02AS3
Material Name	A572 Gr50
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 7600.1

Fabrication History See Page 7600.1

Weld	
Weld Code	016.001.02AS3
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	350 degF
Passes	16
Filler Specification	E7018
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	1200 degF
Post-Weld Heat Time	1 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-75	6	14	10
L-T ◦	-75	7	6	10
L-T ◦	-50	25	19	20
L-T ◦	-50	6	5	10
L-T ◦	-25	123	73	65
L-T ◦	-25	25	17	20
L-T ◦	-25	60	39	40
L-T ◦	0	10	12	20
L-T ◦	0	47	36	40
L-T ◦	25	114	79	40
L-T ◦	25	82	53	45
L-T ◦	50	105	61	65
L-T ◦	50	57	42	60
L-T ◦	75	121	76	70

* - not reported

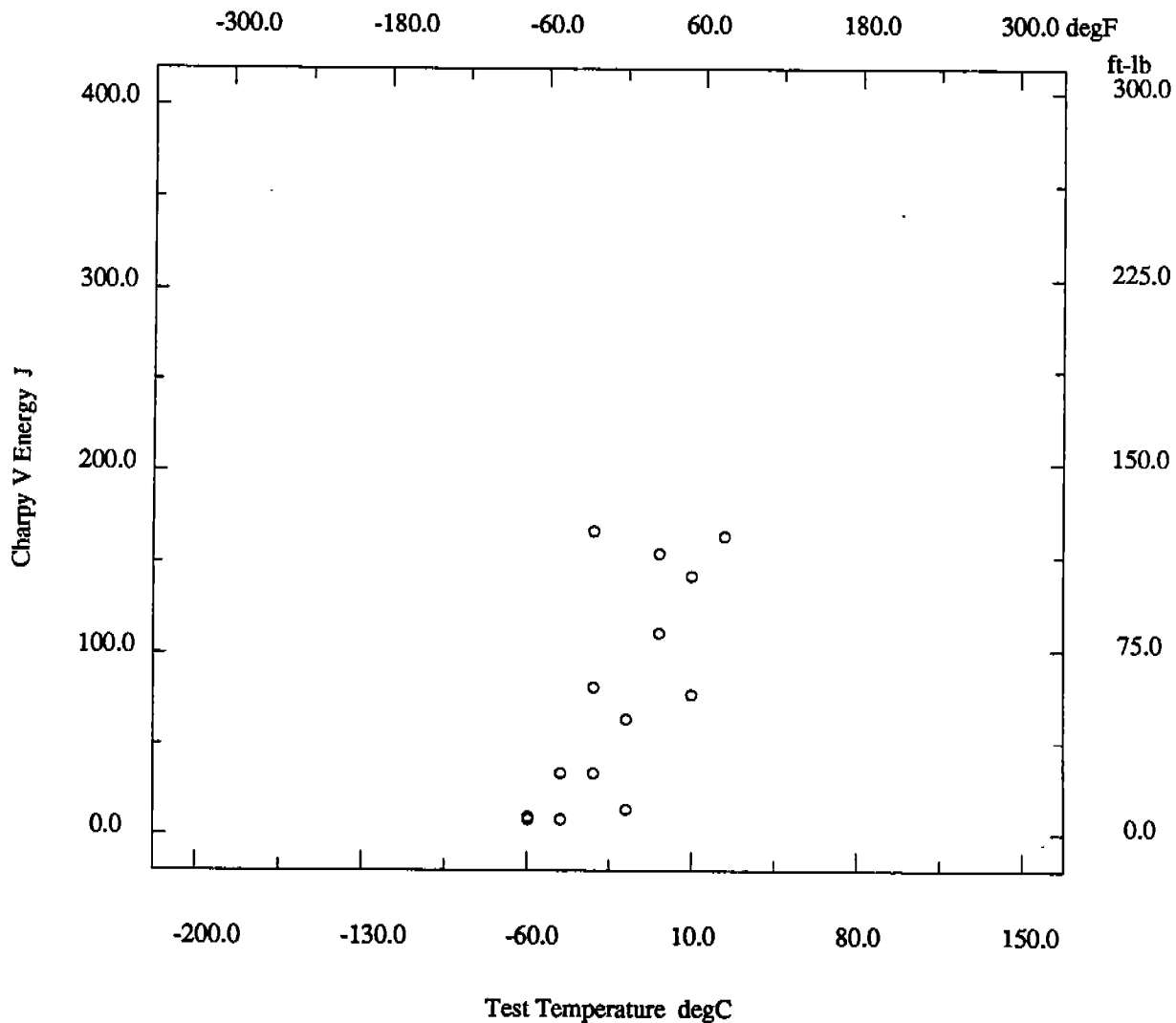
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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.17

Description	
Material Code	016.001.02AS3
Material Name	A572 Gr50
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1



* - not reported

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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.18

Description	
Material Code 016.001.09AS4	Material Name A572 Gr50
UNS *	Other Designation *
Type Welded Joint	Form Plate
Thickness 1 in	Composition Type Actual
Composition Position *	Lot ID *
Reference KONKUL-1	

Composition See Page 7600.1

Fabrication History See Page 7600.1

Weld	
Weld Code 016.001.09AS4	Weld Type SMA
Base Metal Thickness 1 in	Welding Position IG
Preheat Temperature 50 degF	Metal Gap 0 in
Interpass Temperature 350 degF	Passes 16
Filler Specification E7018	Filler Name *
Filler Carbon Content *	Filler Metal Size *
Shielding Gas *	Voltage *
Amperage *	Polarity *
Travel Speed *	Heat Input/Pass 34 KJ/in
Joint Preparation K-Groove	Number of Sides 2
Location wrt Weld 11mm in HAZ	Location wrt Surface Mid thickness at root
Post-Weld Heat Temp 1200 degF	Post-Weld Heat Time 5 hr
Flux Type *	Flux Name *
Weld Composition Reported? No	

Property Measurements	
Test Type Charpy V Impact	Position 3/4T
Specimen Type Full	Did Specimen Fracture? Assumed
Did Specimen Split? *	Standard Method *
Standard Year *	

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-50	15	15	15
L-T ◦	-50	59	49	35
L-T ◦	-50	9	13	15
L-T ◦	-25	17	22	45
L-T ◦	-25	38	36	35
L-T ◦	0	50	53	45
L-T ◦	0	80	64	65
L-T ◦	0	84	69	65
L-T ◦	25	100	78	60
L-T ◦	25	90	74	60
L-T ◦	50	118	95	75
L-T ◦	50	43	46	55
L-T ◦	75	123	86	80

* - not reported

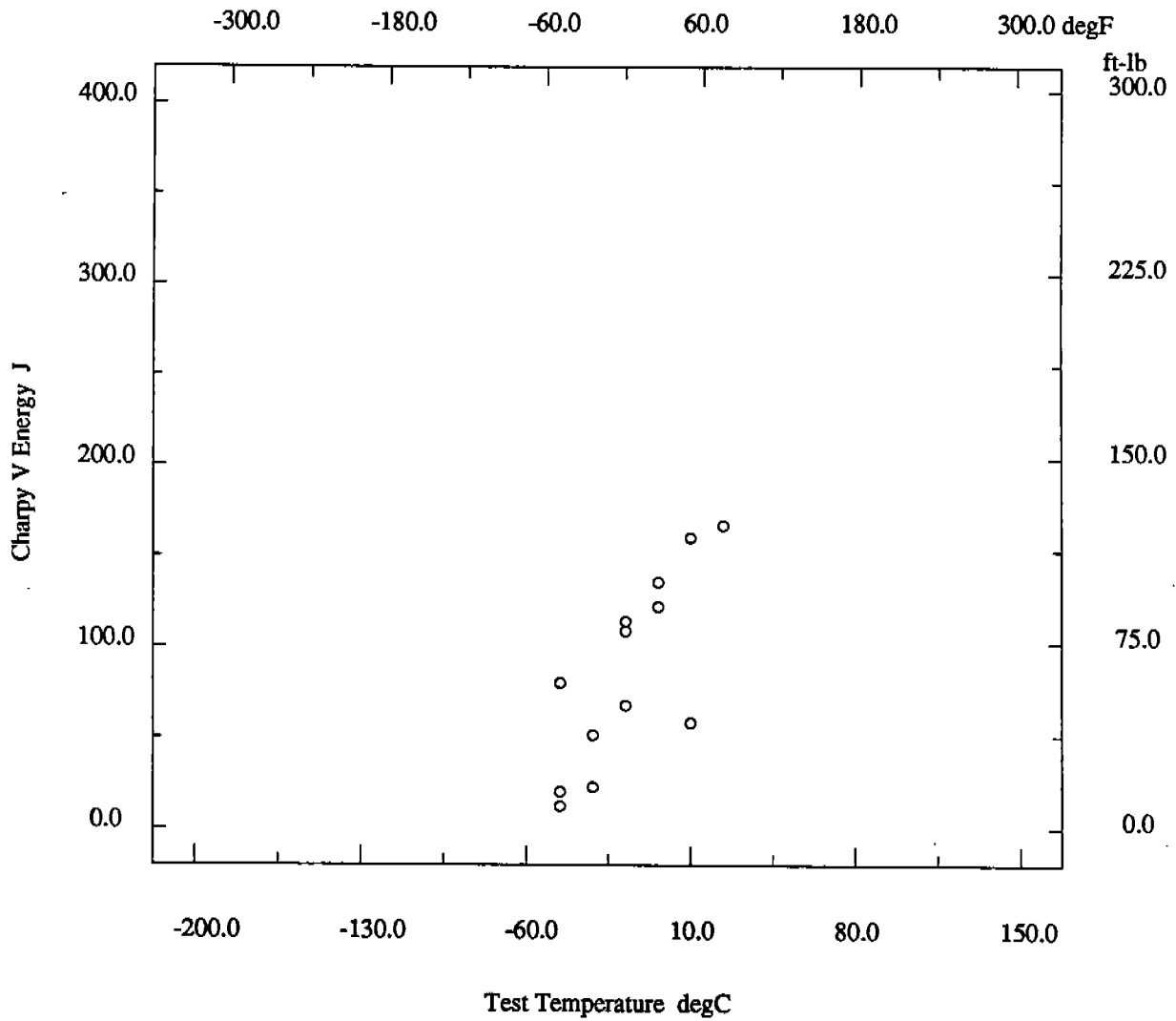
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Marine Structural Toughness Data Bank

Material A572 Gr50

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Description			
Material Code	016.001.09AS4	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7600.20

Description	
Material Code	016.001.02AS4
Material Name	A572 Gr50
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 7600.1

Fabrication History See Page 7600.1

Weld	
Weld Code	016.001.02AS4
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	350 degF
Passes	16
Filler Specification	E7018
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	1200 degF
Post-Weld Heat Time	5 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◊	-50	11	8	10
L-T ◊	-50	21	14	15
L-T ◊	-50	6	8	10
L-T ◊	-25	11	10	40
L-T ◊	-25	30	28	35
L-T ◊	0	156	90	100
L-T ◊	0	16	15	25
L-T ◊	0	78	55	70
L-T ◊	25	125	72	80
L-T ◊	25	90	61	60
L-T ◊	50	159	98	100
L-T ◊	50	167	86	100

* - not reported

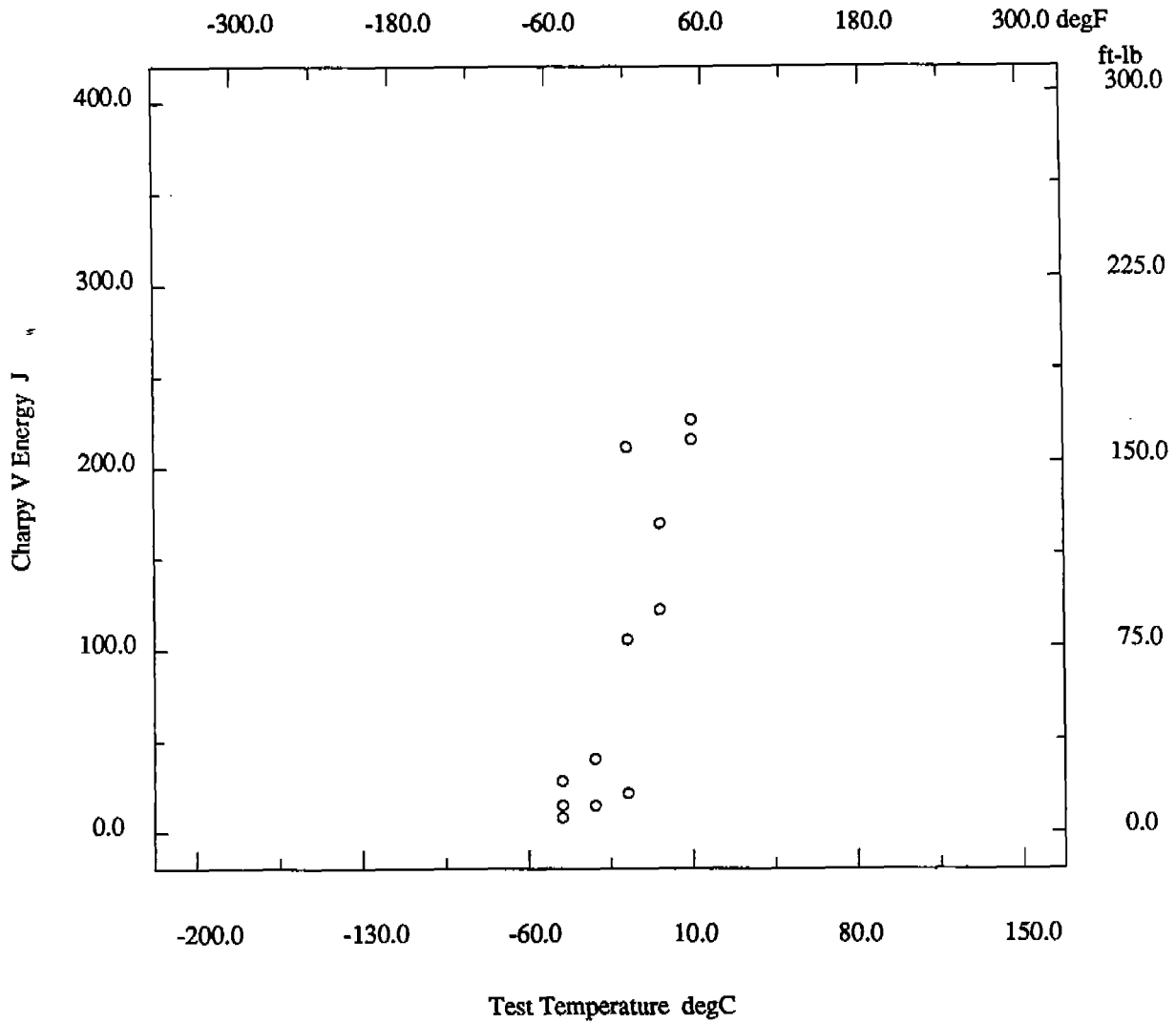
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Marine Structural Toughness Data Bank

Material A572 Gr50

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Description			
Material Code	016.001.02AS4	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.1

Description			
Material Code	016.001.09BA	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		
Composition			
C	0.20 %	Mn	1.24 %
P	0.004 %	S	0.024 %
Si	0.02 %	Cr	0.02 %
Ni	0.04 %	Mo	0.01 %
V	0.089 %	Cu	0.04 %
Cb	<0.005 %	Ti	*
B	*	Al	<0.002 %
N	0.005 %	Other Components	*
Fabrication History			
Heat Treatment	*	Producer	US Steel
Year Produced	*	Addl Info	*
Source	US Steel	Melting Practice	*
Ingot Position	*	Killing Process	*
Process Temperature	*	Process Time	*
Rolling Conditions	*	Final Processing	A,R
Final Temperature	*	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*
Weld			
Weld Code	016.001.09BA	Weld Type	SAW
Base Metal Thickness	1 in	Welding Position	IG
Preheat Temperature	50 degF	Metal Gap	5/16 in
Interpass Temperature	350 degF	Passes	9
Filler Specification	E70-EA2	Filler Name	*
Filler Carbon Content	*	Filler Metal Size	*
Shielding Gas	*	Voltage	*
Amperage	*	Polarity	*
Travel Speed	*	Heat Input/Pass	75 KJ/in
Joint Preparation	V Groove	Number of Sides	1
Location wrt Weld	11mm in HAZ	Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		

* - not reported

(continued)

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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.2

(continued)

Property Measurements			
Test Type	Charpy V Impact	Position	3/4T
Specimen Type	Full	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-150	5	3	5
L-T ◦	-150	5	6	5
L-T ◦	-75	11	8	5
L-T ◦	-75	16	17	5
L-T ◦	-50	19	14	15
L-T ◦	-50	19	15	5
L-T ◦	-25	22	16	10
L-T ◦	-25	25	20	10
L-T ◦	0	31	28	30
L-T ◦	0	37	35	30
L-T ◦	25	36	33	36
L-T ◦	25	45	43	50
L-T ◦	50	37	50	60
L-T ◦	50	43	44	50
L-T ◦	75	50	49	70

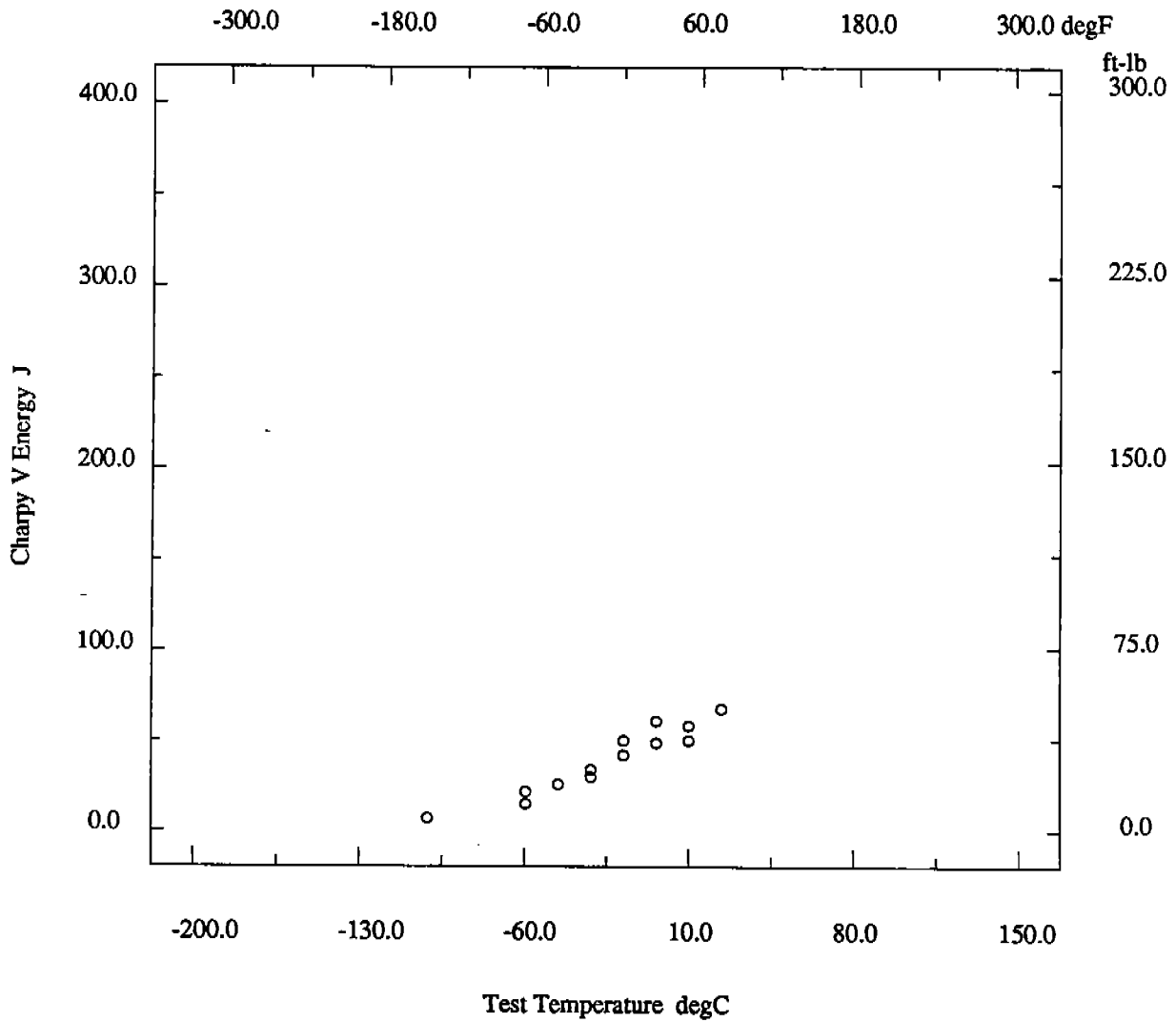
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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.3

Description			
Material Code	016.001.09BA	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.4

Description	
Material Code	016.001.02BA
Material Name	A572 Gr50
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 7700.1

Fabrication History See Page 7700.1

Weld	
Weld Code	016.001.02BA
Weld Type	SAW
Base Metal Thickness	1 in
Welding Position	IG
Preheat Temperature	50 degF
Metal Gap	5/16 in
Interpass Temperature	350 degF
Passes	9
Filler Specification	E70-EA2
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	75 KJ/in
Joint Preparation	V Groove
Number of Sides	1
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	*
Post-Weld Heat Time	*
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T °	-150	7	10	5
L-T °	-150	8	3	5
L-T °	-125	14	7	10
L-T °	-125	15	8	10
L-T °	-100	49	32	30
L-T °	-100	66	40	35
L-T °	-75	55	39	35
L-T °	-75	65	45	35
L-T °	-50	32	23	20
L-T °	-50	55	39	30
L-T °	-25	69	47	40
L-T °	-25	85	62	50
L-T °	0	106	74	80
L-T °	0	87	66	75

* - not reported

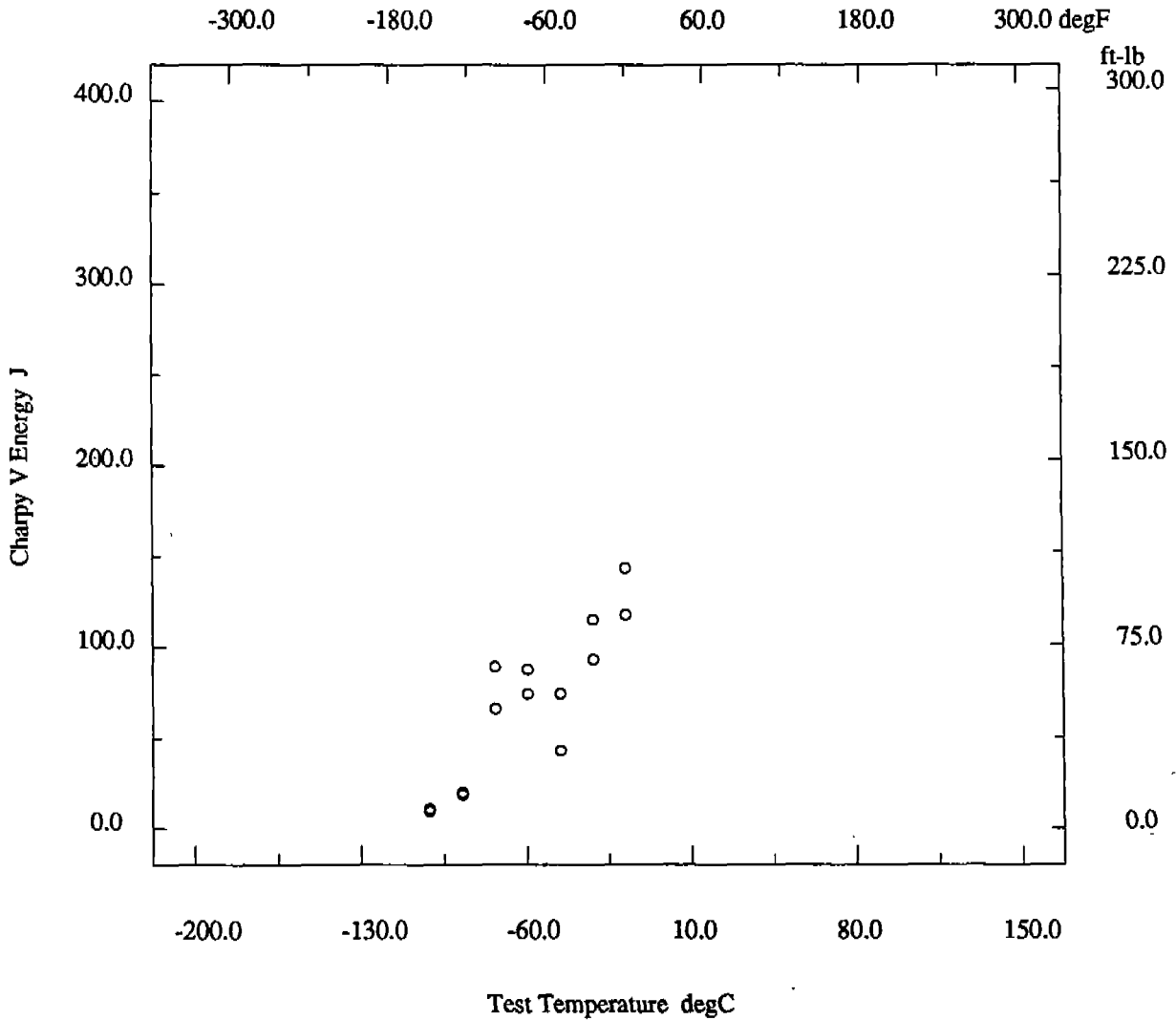
(17)

Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.5

Description			
Material Code	016.001.02BA	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.6

Description	
Material Code	016.001.09BS1
Material Name	A572 Gr50
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 7700.1

Fabrication History See Page 7700.1

Weld	
Weld Code	016.001.09BS1
Weld Type	SAW
Base Metal Thickness	1 in
Welding Position	IG
Preheat Temperature	50 degF
Metal Gap	5/16 in
Interpass Temperature	350 degF
Passes	9
Filler Specification	E70-EA2
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	75 KJ/in
Joint Preparation	V Groove
Number of Sides	1
Location wrt Weld	11mm in HAZ
Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	1100 degF
Post-Weld Heat Time	1 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T °	-75	10	8	10
L-T °	-75	8	6	5
L-T °	-50	17	13	20
L-T °	-50	23	18	20
L-T °	-25	18	17	35
L-T °	-25	22	24	30
L-T °	0	24	24	20
L-T °	0	40	36	25
L-T °	25	45	45	35
L-T °	25	46	44	40
L-T °	50	37	37	40
L-T °	50	61	58	65
L-T °	75	60	61	75
L-T °	75	65	63	65

* - not reported

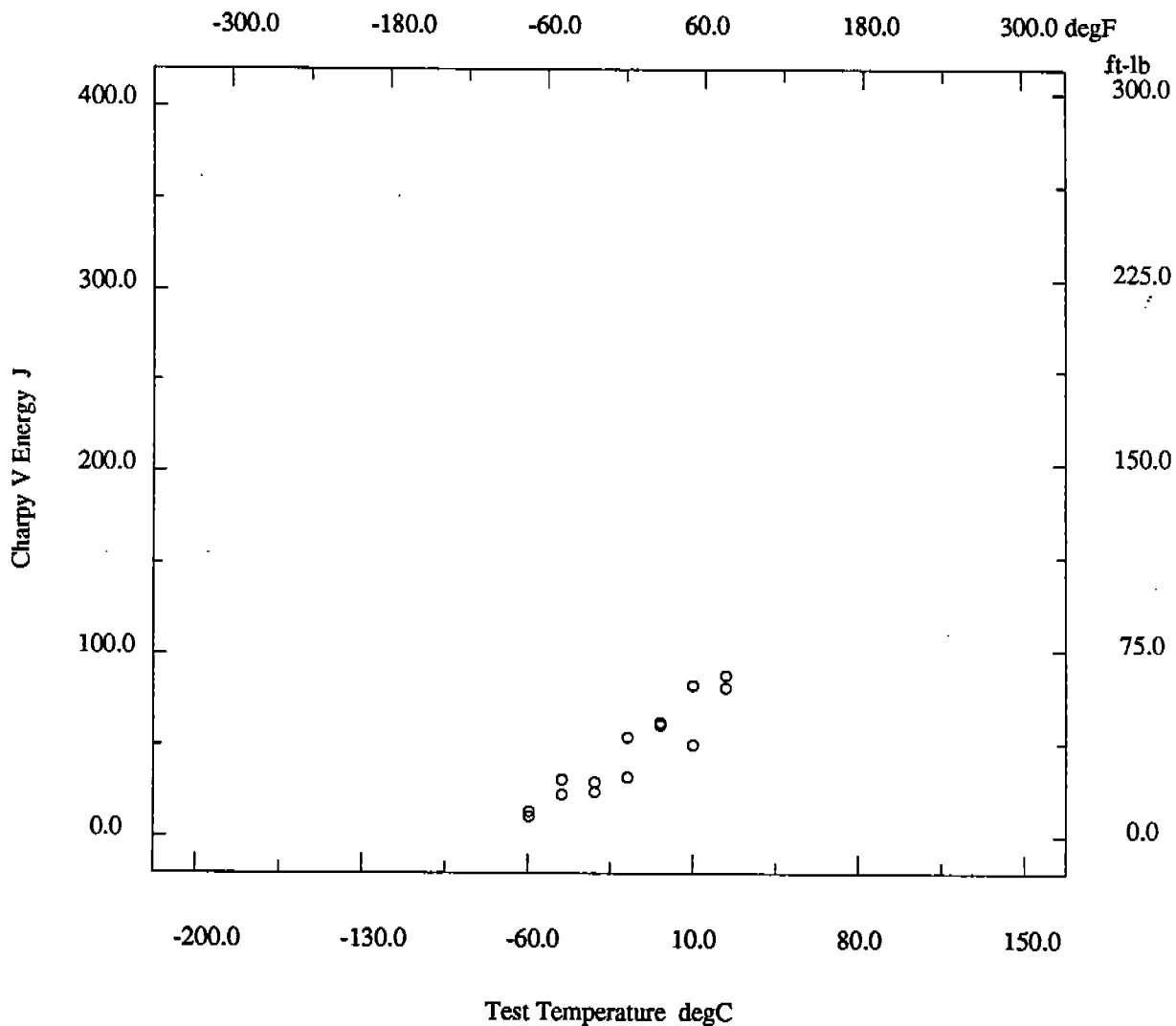


Marine Structural Toughness Data Bank

Material A572 Gr50

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Description			
Material Code	016.001.09BS1	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.8

Description	
Material Code 016.001.02BS1	Material Name A572 Gr50
UNS *	Other Designation *
Type Welded Joint	Form Plate
Thickness 1 in	Composition Type Actual
Composition Position *	Lot ID *
Reference KONKUL-1	
Composition	See Page 7700.1
Fabrication History	See Page 7700.1
Weld	
Weld Code 016.001.02BS1	Weld Type SAW
Base Metal Thickness 1 in	Welding Position IG
Preheat Temperature 50 degF	Metal Gap 5/16 in
Interpass Temperature 350 degF	Passes 9
Filler Specification E70-EA2	Filler Name *
Filler Carbon Content *	Filler Metal Size *
Shielding Gas *	Voltage *
Amperage *	Polarity *
Travel Speed *	Heat Input/Pass 75 KJ/in
Joint Preparation V Groove	Number of Sides 1
Location wrt Weld Fusion line	Location wrt Surface Mid thickness not root
Post-Weld Heat Temp 1100 degF	Post-Weld Heat Time 1 hr
Flux Type *	Flux Name *
Weld Composition Reported? No	
Property Measurements	
Test Type Charpy V Impact	Position 3/4T
Specimen Type Full	Did Specimen Fracture? Assumed
Did Specimen Split? *	Standard Method *
Standard Year *	

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-125	6	4	5
L-T ◦	-125	6	7	5
L-T ◦	-100	45	29	20
L-T ◦	-100	8	4	10
L-T ◦	-75	11	8	15
L-T ◦	-75	55	36	25
L-T ◦	-50	30	23	30
L-T ◦	-50	45	33	30
L-T ◦	-25	58	42	40
L-T ◦	-25	81	60	70
L-T ◦	0	54	44	40
L-T ◦	0	75	50	70
L-T ◦	50	95	74	70
L-T ◦	50	95	76	70

* - not reported

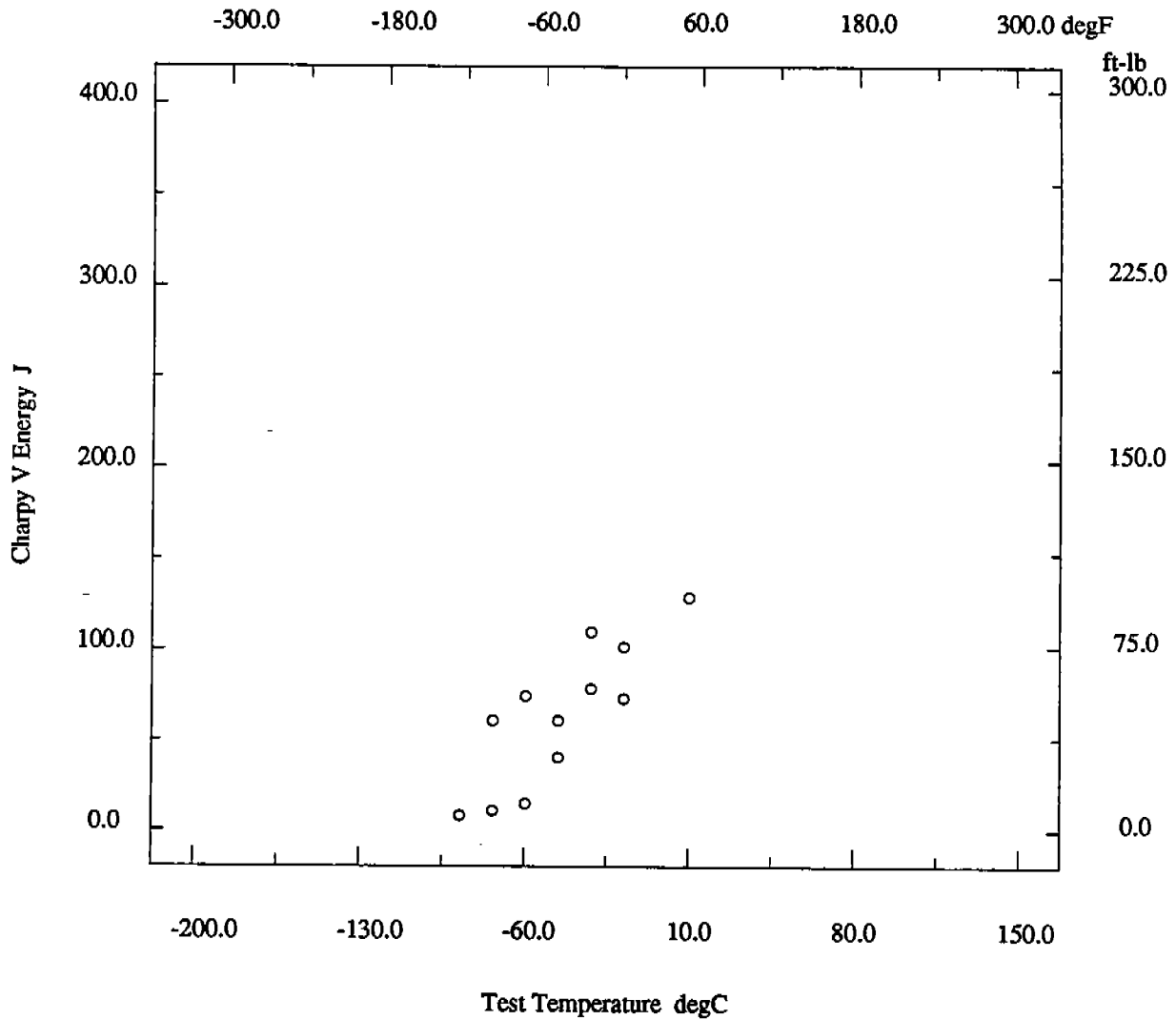
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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.9

Description			
Material Code	016.001.02BS1	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported



Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.10

Description			
Material Code	016.001.09BS2	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		
Composition		See Page 7700.1	
Fabrication History		See Page 7700.1	
Weld			
Weld Code	016.001.09BS2	Weld Type	SAW
Base Metal Thickness	1 in	Welding Position	IG
Preheat Temperature	50 degF	Metal Gap	5/16 in
Interpass Temperature	350 degF	Passes	9
Filler Specification	E70-EA2	Filler Name	*
Filler Carbon Content	*	Filler Metal Size	*
Shielding Gas	*	Voltage	*
Amperage	*	Polarity	*
Travel Speed	*	Heat Input/Pass	75 KJ/in
Joint Preparation	V Groove	Number of Sides	1
Location wrt Weld	11mm in HAZ	Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	1100 degF	Post-Weld Heat Time	5 hr
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		
Property Measurements			
Test Type	Charpy V Impact	Position	3/4T
Specimen Type	Full	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-50	20	16	15
L-T ◦	-50	6	5	5
L-T ◦	-25	11	12	15
L-T ◦	-25	20	21	15
L-T ◦	-25	38	34	25
L-T ◦	0	10	13	20
L-T ◦	0	37	36	30
L-T ◦	0	41	39	30
L-T ◦	25	27	33	35
L-T ◦	25	30	31	25
L-T ◦	50	55	53	70
L-T ◦	50	60	55	75
L-T ◦	75	58	61	80
L-T ◦	75	63	57	65
L-T ◦	100	62	63	80

* - not reported

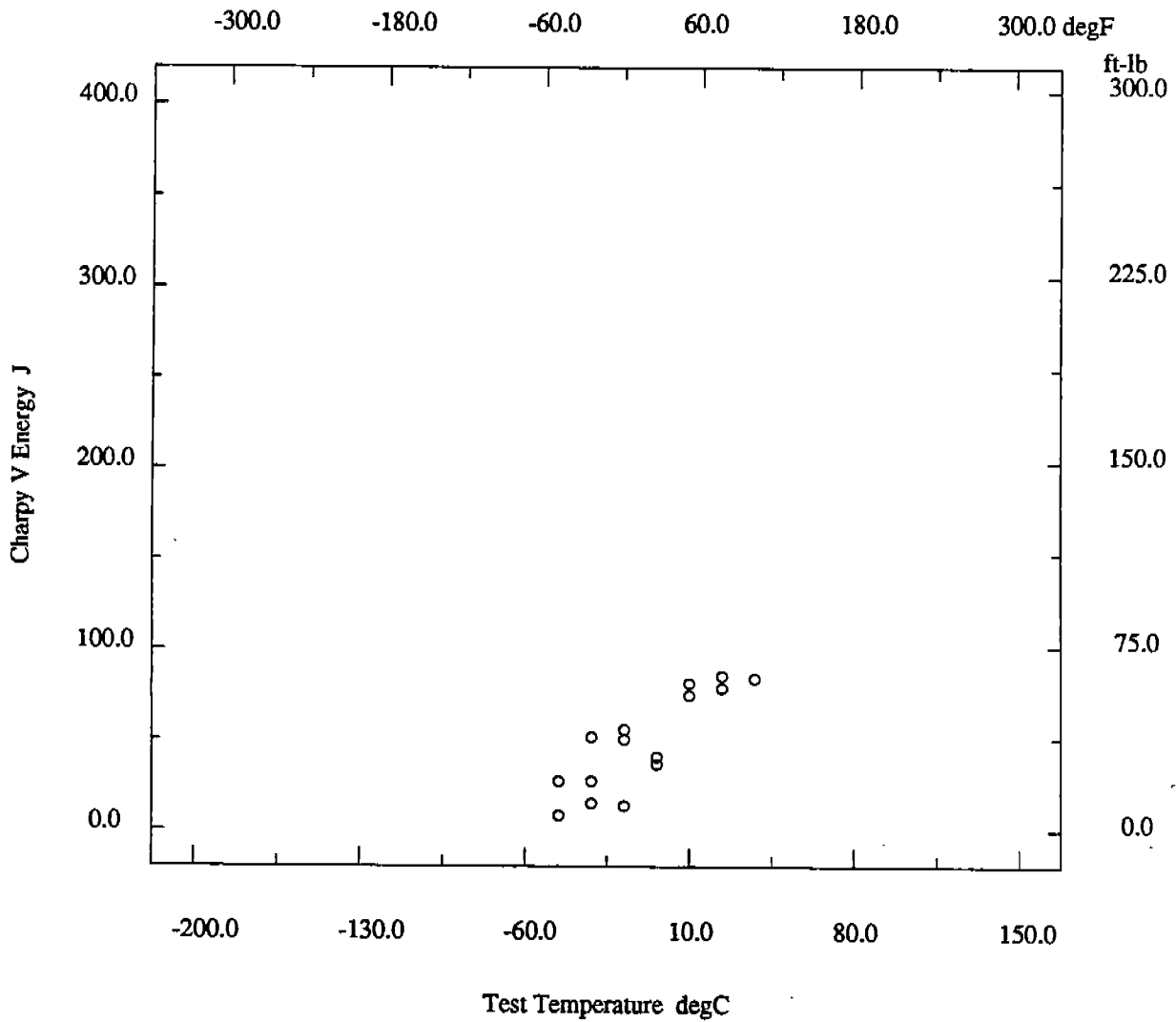


Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.11

Description					
Material Code	016.001.09BS2	Material Name	.....	A572 Gr50
UNS	*	Other Designation	.....	*
Type	Welded Joint	Form	.....	Plate
Thickness	1 in	Composition Type	.....	Actual
Composition Position	*	Lot ID	.....	*
Reference	KONKUL-1			



* - not reported



Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.12

Description			
Material Code	016.001.02BS2	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		

Composition See Page 7700.1

Fabrication History See Page 7700.1

Weld			
Weld Code	016.001.02BS2	Weld Type	SAW
Base Metal Thickness	1 in	Welding Position	IG
Preheat Temperature	50 degF	Metal Gap	5/16 in
Interpass Temperature	350 degF	Passes	9
Filler Specification	E70-EA2	Filler Name	*
Filler Carbon Content	*	Filler Metal Size	*
Shielding Gas	*	Voltage	*
Amperage	*	Polarity	*
Travel Speed	*	Heat Input/Pass	75 KJ/in
Joint Preparation	V Groove	Number of Sides	1
Location wrt Weld	Fusion line	Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	1100 degF	Post-Weld Heat Time	5 hr
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		

Property Measurements			
Test Type	Charpy V Impact	Position	3/4T
Specimen Type	Full	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-75	10	7	5
L-T ◦	-75	14	9	5
L-T ◦	-50	30	21	15
L-T ◦	-50	53	38	30
L-T ◦	-50	72	74	35
L-T ◦	-25	25	20	15
L-T ◦	-25	34	27	25
L-T ◦	0	61	45	50
L-T ◦	0	74	54	45
L-T ◦	25	87	66	65
L-T ◦	25	88	61	60
L-T ◦	50	105	78	100
L-T ◦	50	89	73	85

* - not reported

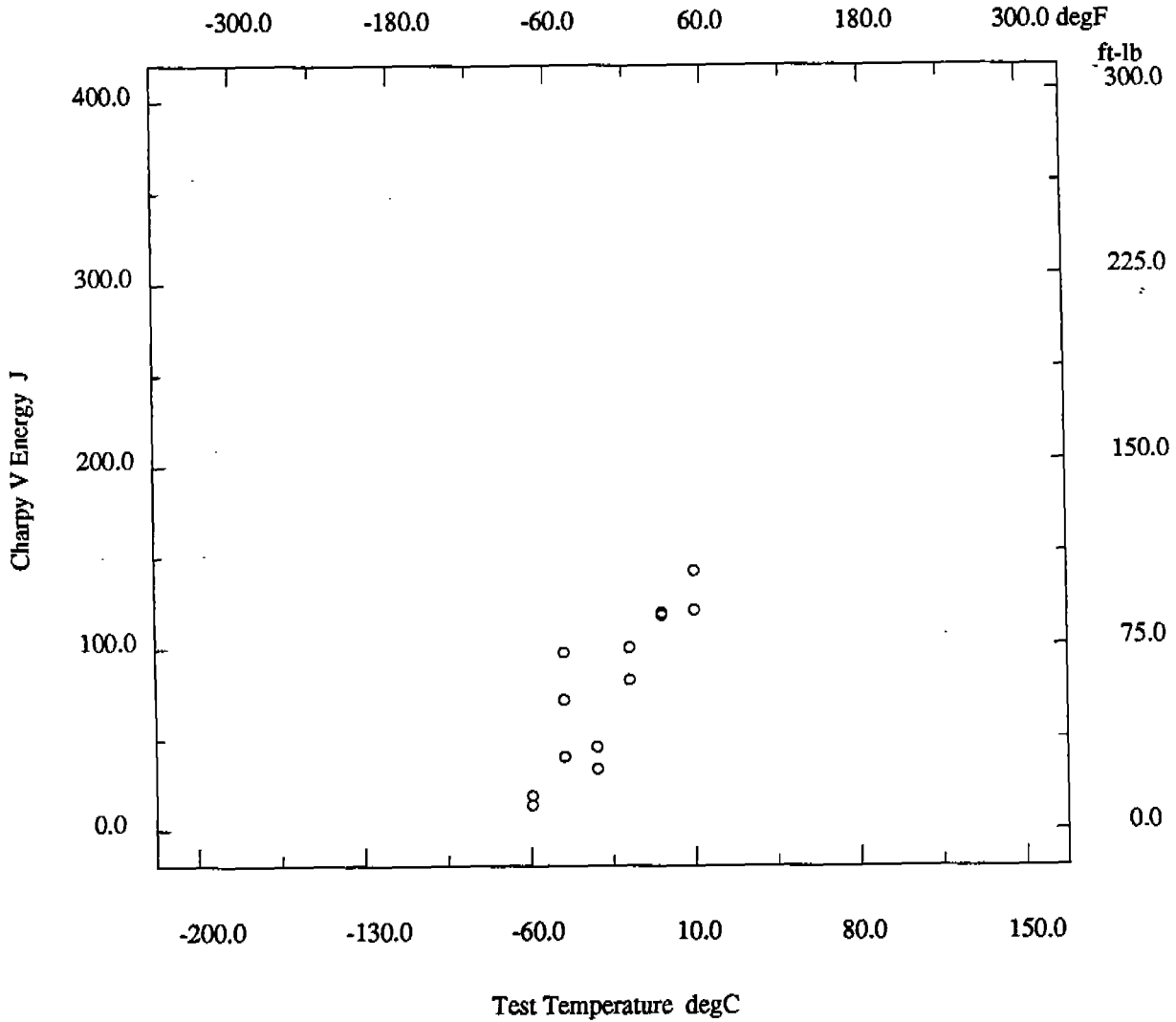
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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.13

Description			
Material Code	016.001.02BS2	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.14

Description	
Material Code 016.001.09BS3	Material Name A572 Gr50
UNS *	Other Designation *
Type Welded Joint	Form Plate
Thickness 1 in	Composition Type Actual
Composition Position *	Lot ID *
Reference KONKUL-1	
Composition	See Page 7700.1
Fabrication History	See Page 7700.1
Weld	
Weld Code 016.001.09BS3	Weld Type SAW
Base Metal Thickness 1 in	Welding Position IG
Preheat Temperature 50 degF	Metal Gap 5/16 in
Interpass Temperature 350 degF	Passes 9
Filler Specification E70-EA2	Filler Name *
Filler Carbon Content *	Filler Metal Size *
Shielding Gas *	Voltage *
Amperage *	Polarity *
Travel Speed *	Heat Input/Pass 75 KJ/in
Joint Preparation V Groove	Number of Sides 1
Location wrt Weld 11mm in HAZ	Location wrt Surface Mid thickness not root
Post-Weld Heat Temp 1200 degF	Post-Weld Heat Time 1 hr
Flux Type *	Flux Name *
Weld Composition Reported? No	
Property Measurements	
Test Type Charpy V Impact	Position 3/4T
Specimen Type Full	Did Specimen Fracture? Assumed
Did Specimen Split? *	Standard Method *
Standard Year *	

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-25	11	12	10
L-T ◦	-25	28	25	15
L-T ◦	-25	8	13	15
L-T ◦	0	33	41	25
L-T ◦	0	35	35	30
L-T ◦	0	44	40	25
L-T ◦	25	40	40	35
L-T ◦	25	48	42	55
L-T ◦	50	58	53	55
L-T ◦	50	60	57	60
L-T ◦	72	45	49	60
L-T ◦	72	46	48	60
L-T ◦	100	52	57	70
L-T ◦	100	65	68	80

* - not reported

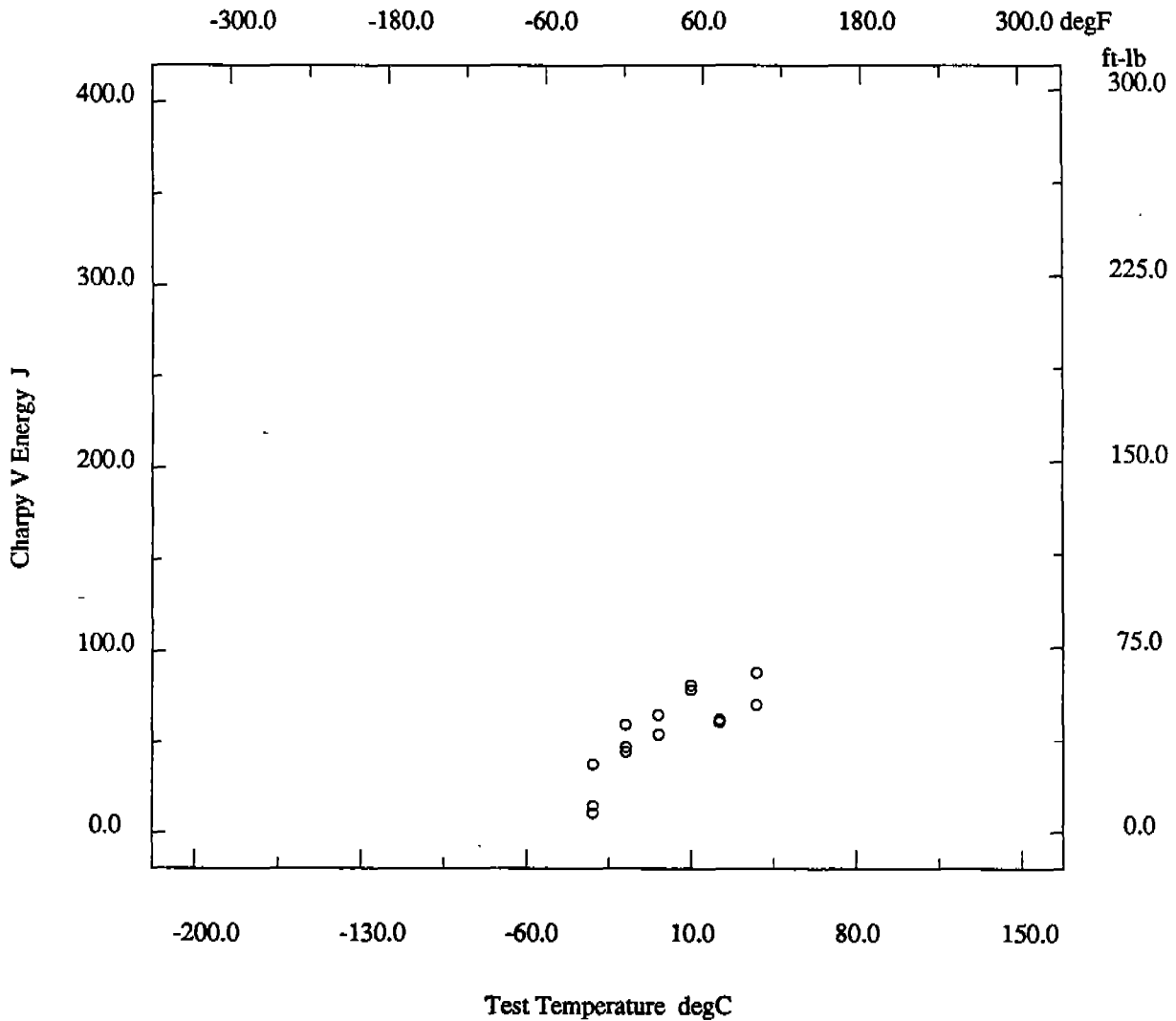


Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.15

Description			
Material Code	016.001.09BS3	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.16

Description	
Material Code	016.001.02BS3
Material Name	A572 Gr50
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 7700.1

Fabrication History See Page 7700.1

Weld	
Weld Code	016.001.02BS3
Weld Type	SAW
Base Metal Thickness	1 in
Welding Position	IG
Preheat Temperature	50 degF
Metal Gap	5/16 in
Interpass Temperature	350 degF
Passes	9
Filler Specification	E70-EA2
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	75 KJ/in
Joint Preparation	V Groove
Number of Sides	1
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	1200 degF
Post-Weld Heat Time	1 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-100	12	9	5
L-T ◦	-100	6	5	5
L-T ◦	-75	15	8	10
L-T ◦	-75	51	37	25
L-T ◦	-50	61	42	25
L-T ◦	-50	80	55	30
L-T ◦	-25	53	41	35
L-T ◦	-25	72	54	40
L-T ◦	-25	91	63	50
L-T ◦	0	42	31	35
L-T ◦	0	55	47	50
L-T ◦	0	82	65	60

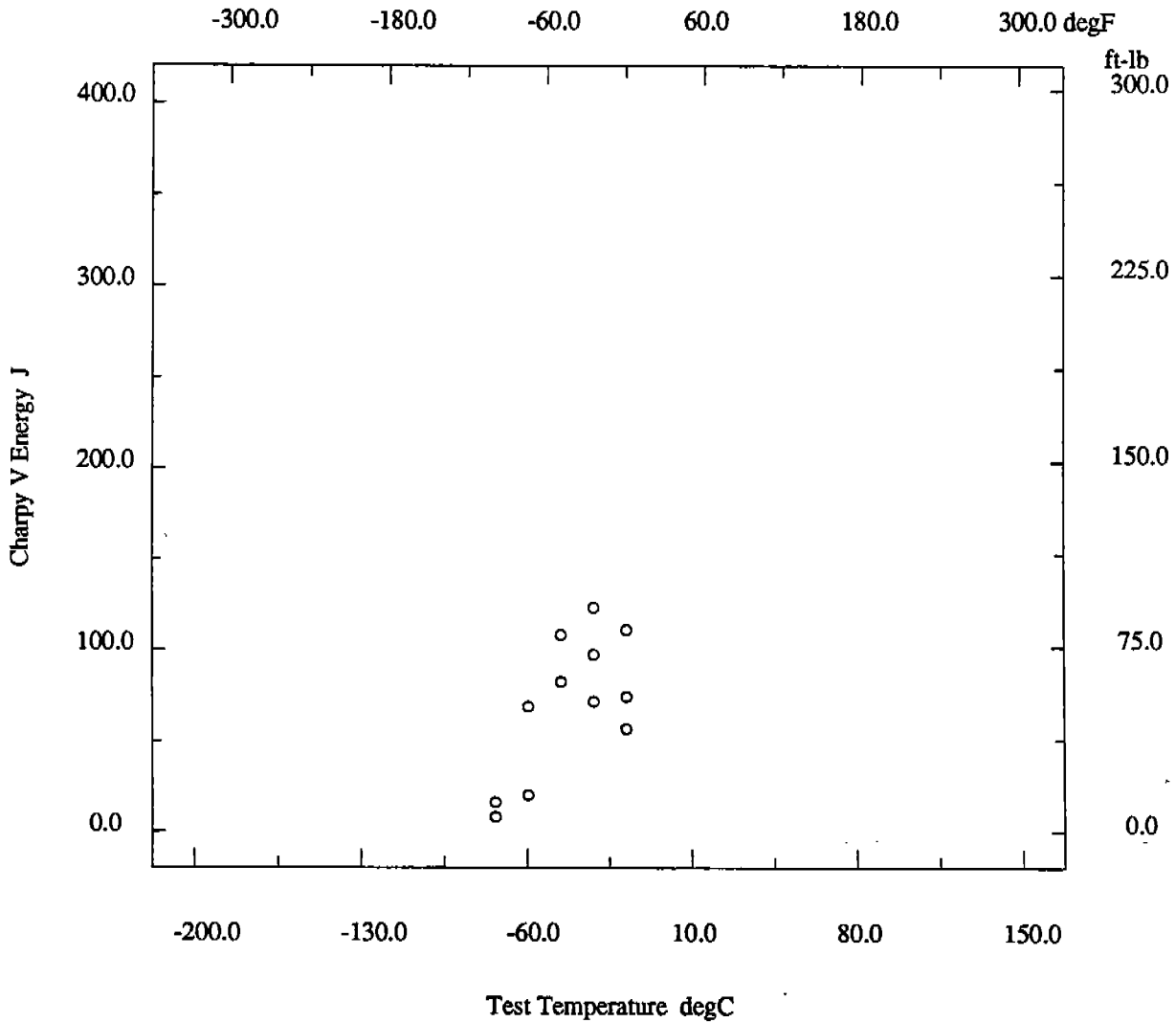
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Marine Structural Toughness Data Bank

Material A572 Gr50

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Description			
Material Code	016.001.02BS3	Material Name	A572 Gr50
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

(fit)

Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.18

Description	
Material Code	016.001.09BS4
Material Name	A572 Gr50
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 7700.1

Fabrication History See Page 7700.1

Weld	
Weld Code	016.001.09BS4
Weld Type	SAW
Base Metal Thickness	1 in
Welding Position	IG
Preheat Temperature	50 degF
Metal Gap	5/16 in
Interpass Temperature	350 degF
Passes	9
Filler Specification	E70-EA2
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	75 KJ/in
Joint Preparation	V Groove
Number of Sides	1
Location wrt Weld	11mm in HAZ
Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	1200 degF
Post-Weld Heat Time	5 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◊	-25	11	12	15
L-T ◊	-25	20	17	15
L-T ◊	-25	9	12	15
L-T ◊	0	18	24	20
L-T ◊	0	21	18	15
L-T ◊	0	8	18	20
L-T ◊	25	40	38	20
L-T ◊	25	46	46	20
L-T ◊	50	32	34	40
L-T ◊	50	46	45	40
L-T ◊	72	50	55	85
L-T ◊	72	51	54	60
L-T ◊	100	56	56	70
L-T ◊	100	57	59	80

* - not reported

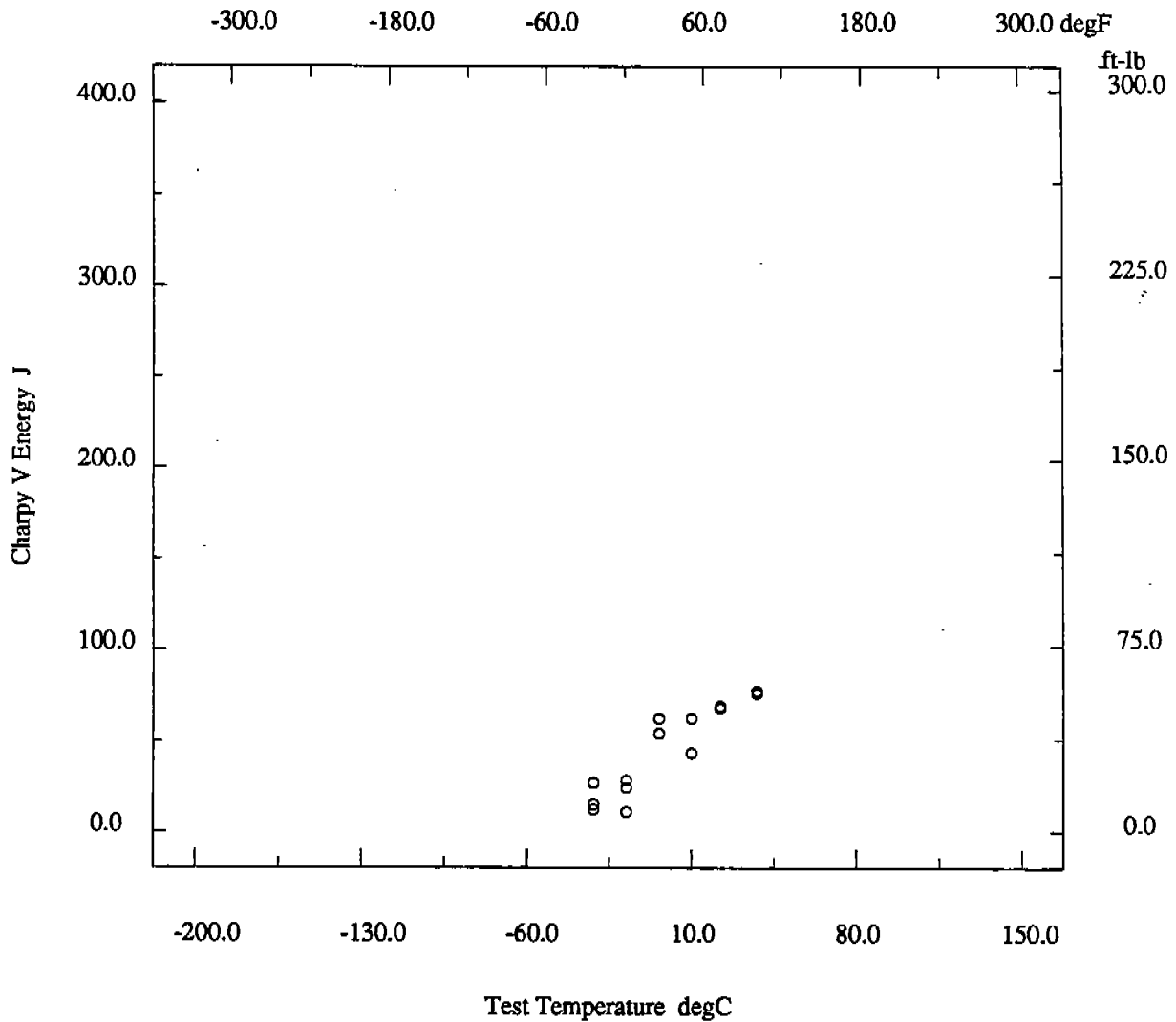


Marine Structural Toughness Data Bank

Material A572 Gr50

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Description				
Material Code	016.001.09BS4	Material Name	A572 Gr50	
UNS	*	Other Designation	*	
Type	Welded Joint	Form	Plate	
Thickness	1 in	Composition Type	Actual	
Composition Position	*	Lot ID	*	
Reference	KONKUL-1			



* - not reported



Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.20

Description	
Material Code	016.001.02BS4
Material Name	A572 Gr50
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1
Composition	
See Page 7700.1	
Fabrication History	
See Page 7700.1	
Weld	
Weld Code	016.001.02BS4
Weld Type	SAW
Base Metal Thickness	1 in
Welding Position	IG
Preheat Temperature	50 degF
Metal Gap	5/16 in
Interpass Temperature	350 degF
Passes	9
Filler Specification	E70-EA2
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	75 KJ/in
Joint Preparation	V Groove
Number of Sides	1
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	1200 degF
Post-Weld Heat Time	5 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No
Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-100	3	3	5
L-T ◦	-100	4	0	5
L-T ◦	-75	5	2	5
L-T ◦	-75	67	46	30
L-T ◦	-50	20	14	10
L-T ◦	-50	85	58	40
L-T ◦	-25	44	31	20
L-T ◦	-25	58	41	40
L-T ◦	-25	80	57	30
L-T ◦	0	52	38	30
L-T ◦	0	52	41	30
L-T ◦	0	80	56	50
L-T ◦	50	113	83	85
L-T ◦	50	120	86	80
L-T ◦	72	114	86	100

* - not reported

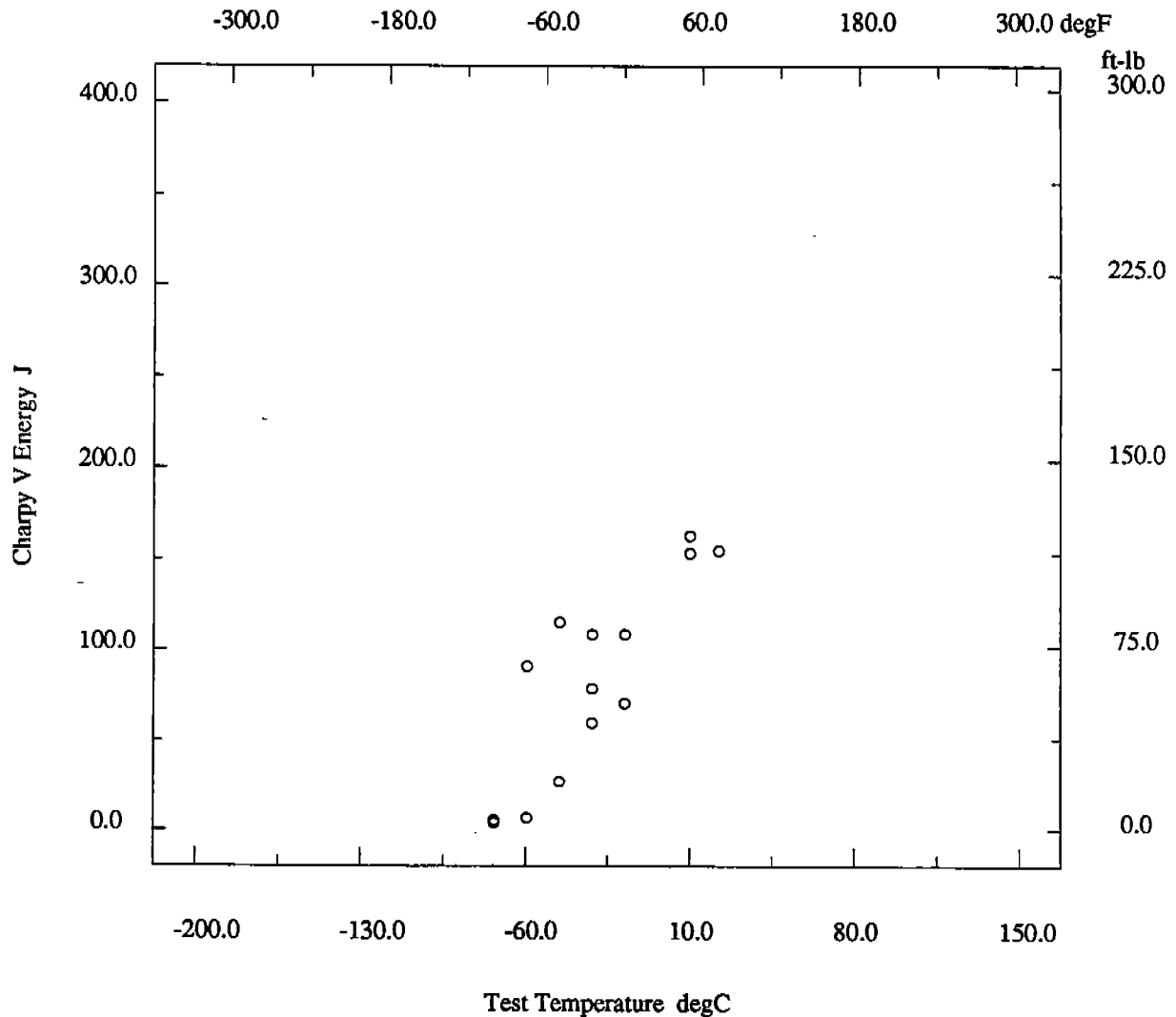
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Marine Structural Toughness Data Bank

Material A572 Gr50

Page 7700.21

Description	
Material Code	016.001.02BS4
Material Name	A572 Gr50
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1



* - not reported

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Marine Structural Toughness Data Bank

Material A588

Page 8000.1

Description			
Material Code	012.001.09A	Material Name	A588
UNS	*	Other Designation	Grade A
Type	Welded Joint	Form	Plate
Thickness	3 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	OGC-1		
Composition			
C	0.18 %	Mn	1.20 %
P	0.01 %	S	0.02 %
Si	0.37 %	Cr	0.56 %
Ni	0.16 %	Mo	*
V	*	Cu	0.32 %
Cb	*	Ti	*
B	*	Al	0.009 %
N	*	Other Components	None %
Fabrication History			
Heat Treatment	*	Producer	US Steel
Year Produced	*	Addl Info	None
Source	OGC	Melting Practice	*
Ingot Position	*	Killing Process	*
Process Temperature	*	Process Time	*
Rolling Conditions	*	Final Processing	*
Final Temperature	*	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*
Weld			
Weld Code	012.001.09A	Weld Type	ESW
Base Metal Thickness	3 in	Welding Position	Vertical
Preheat Temperature	*	Metal Gap	1.25 in
Interpass Temperature	*	Passes	*
Filler Specification	*	Filler Name	LindeWS
Filler Carbon Content	0.09 %	Filler Metal Size	*
Shielding Gas	*	Voltage	38 volts
Amperage	850 amps	Polarity	*
Travel Speed	*	Heat Input/Pass	3835 KJ/in
Joint Preparation	Smooth Butt	Number of Sides	*
Location wrt Weld	11mm in HAZ	Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	Hobart201
Weld Composition Reported?	No		

* - not reported

(continued)

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Marine Structural Toughness Data Bank

Material A588

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(continued)

Property Measurements			
Test Type	Charpy V Impact	Specimen Type	Full
Lateral Expansion	*	Shear Fracture	*
Did Specimen Fracture?	Yes	Did Specimen Split?	No
Standard Method	*	Standard Year	*

Position	Orien	Test Temp degF	CVN Energy ft-lb
1/4T	T-L ◦	-65	2.0
1/4T	T-L ◦	-65	2.0
1/2T	T-L ◦	-40	2.2
1/2T	T-L ◦	-40	2.2
1/2T	T-L ◦	-20	3.0
1/2T	T-L ◦	-20	3.4
1/4T	T-L ◦	-20	2.0
1/2T	T-L ◦	0	4.0
1/2T	T-L ◦	0	7.0
1/4T	T-L ◦	0	3.0
1/4T	T-L ◦	0	4.0
1/2T	T-L ◦	32	7.0
1/2T	T-L ◦	32	8.0
1/2T	T-L ◦	50	10.0
1/2T	T-L ◦	50	19.0
1/4T	T-L ◦	50	14.0
1/4T	T-L ◦	50	16.5
1/2T	T-L ◦	68	34.5
1/2T	T-L ◦	68	42.5
1/4T	T-L ◦	68	20.0
1/4T	T-L ◦	68	21.0
1/2T	T-L ◦	100	45.0
1/2T	T-L ◦	100	49.0
1/4T	T-L ◦	104	61.0
1/4T	T-L ◦	104	63.0
1/2T	T-L ◦	150	62.0
1/2T	T-L ◦	150	64.0
1/4T	T-L ◦	160	68.0
1/4T	T-L ◦	160	71.0
1/2T	T-L ◦	200	72.0

* - not reported

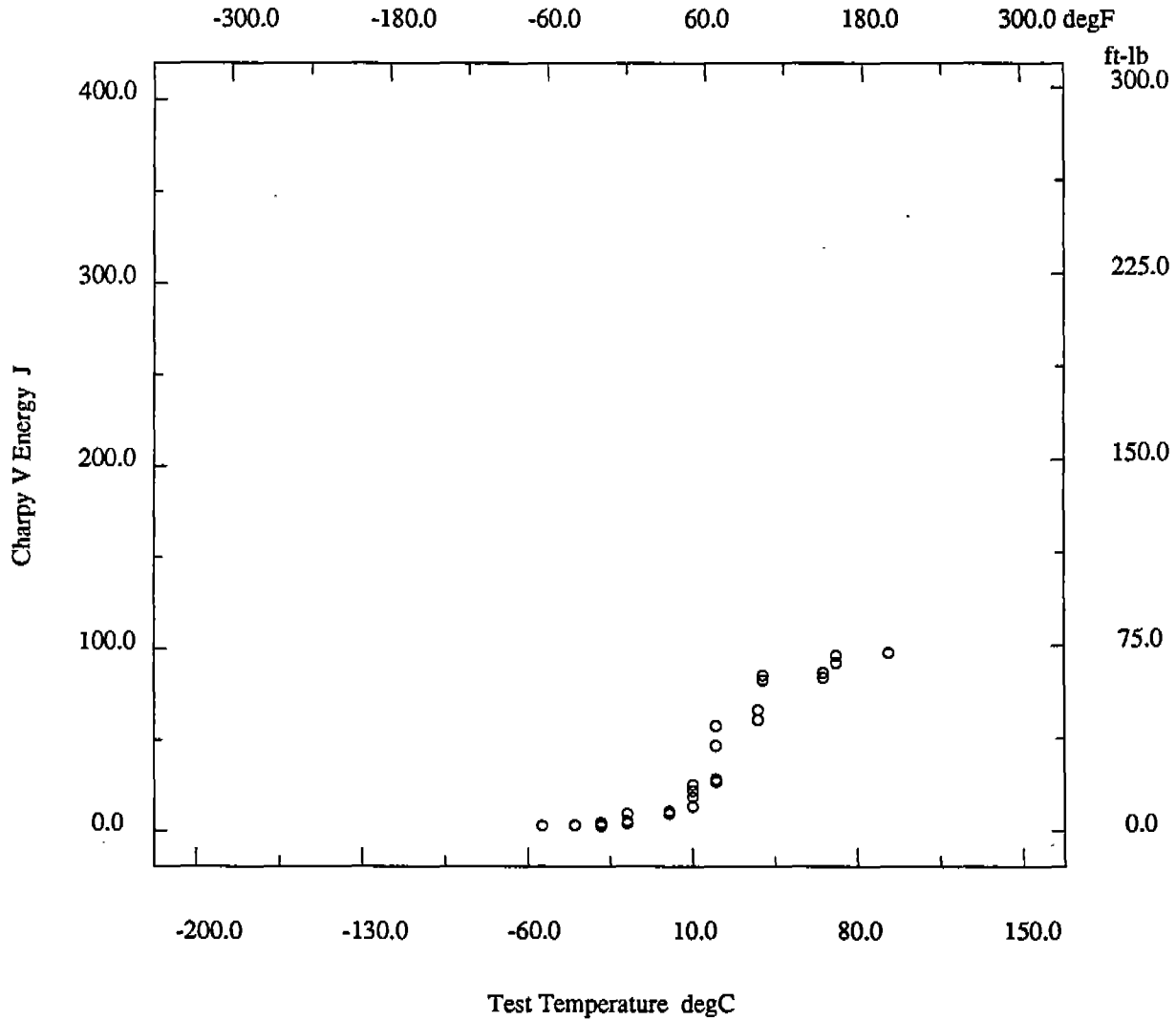
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Marine Structural Toughness Data Bank

Material A588

Page 8000.3

Description			
Material Code	012.001.09A	Material Name	A588
UNS	*	Other Designation	Grade A
Type	Welded Joint	Form	Plate
Thickness	3 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	OGC-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A588

Page 8000.4

Description			
Material Code	012.001.03A	Material Name	A588
UNS	*	Other Designation	Grade A
Type	Welded Joint	Form	Plate
Thickness	3 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	OGC-1		

Composition	See Page 8000.1
--------------------	-----------------

Fabrication History	See Page 8000.1
----------------------------	-----------------

Weld			
Weld Code	012.001.03A	Weld Type	ESW
Base Metal Thickness	3 in	Welding Position	Vertical
Preheat Temperature	*	Metal Gap	1.25 in
Interpass Temperature	*	Passes	*
Filler Specification	*	Filler Name	LindeWS
Filler Carbon Content	0.09 %	Filler Metal Size	*
Shielding Gas	*	Voltage	38 volts
Amperage	850 amps	Polarity	*
Travel Speed	*	Heat Input/Pass	3835 KJ/in
Joint Preparation	Smooth Butt	Number of Sides	*
Location wrt Weld	1mm in HAZ	Location wrt Surface	Mid thickness not root
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	Hobart201
Weld Composition Reported?	No		

Property Measurements			
Test Type	Charpy V Impact	Position	*
Specimen Type	Full	Lateral Expansion	*
Shear Fracture	*	Did Specimen Fracture?	Yes
Did Specimen Split?	No	Standard Method	*
Standard Year	*		

Orien	Test Temp degF	CVN Energy ft-lb
T-L ◦	-40	1.5
T-L ◦	-40	1.5
T-L ◦	-20	3.3
T-L ◦	-20	3.6
T-L ◦	0	2.0
T-L ◦	0	2.7
T-L ◦	32	4.0
T-L ◦	50	3.0
T-L ◦	50	3.0
T-L ◦	68	16.0
T-L ◦	68	5.0
T-L ◦	100	12.0
T-L ◦	100	13.0
T-L ◦	150	27.0
T-L ◦	200	41.5
T-L ◦	200	75.0

* - not reported

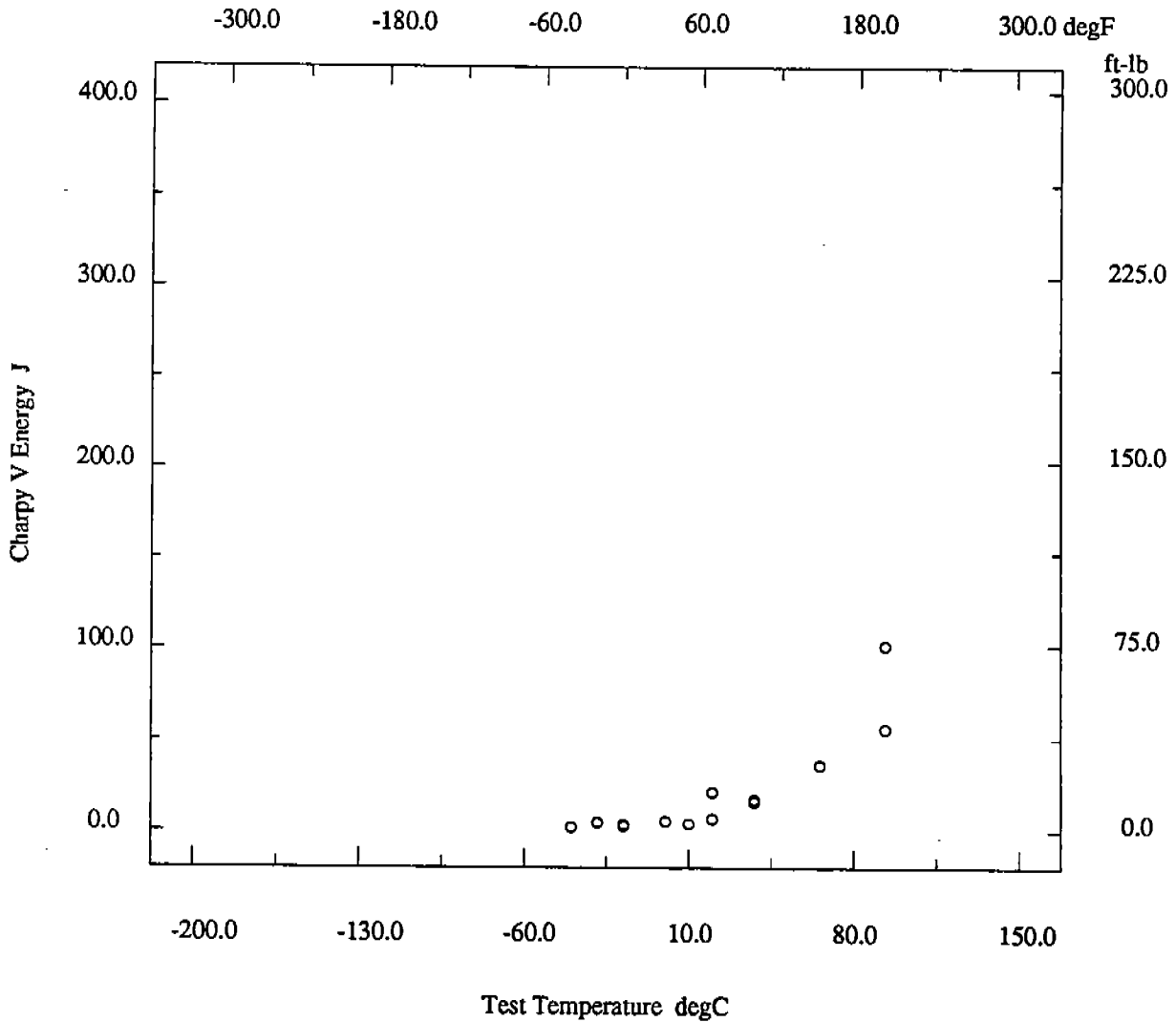


Marine Structural Toughness Data Bank

Material A588

Page 8000.5

Description			
Material Code	012.001.03A	Material Name	A588
UNS	*	Other Designation	Grade A
Type	Welded Joint	Form	Plate
Thickness	3 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	OGC-1		



* - not reported

(10) 2024

Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.1

Description			
Material Code	012.005.010A	Material Name	A588 GrA
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		

Composition			
C	0.200 %	Mn	1.000 %
P	0.007 %	S	0.026 %
Si	0.460 %	Cr	0.610 %
Ni	0.200 %	Mo	0.030 %
V	0.087 %	Cu	0.330 %
Cb	<0.005 %	Ti	*
B	*	Al	0.024 %
N	0.007 %	Other Components	*

Fabrication History			
Heat Treatment	*	Producer	US Steel
Year Produced	*	Addl Info	*
Source	US Steel	Melting Practice	*
Ingot Position	*	Killing Process	*
Process Temperature	*	Process Time	*
Rolling Conditions	*	Final Processing	N
Final Temperature	*	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Tensile	Position	1/4T
Orientation	*	Specimen Type	Cylindrical
Specimen Thickness	0.357 in	Gage Length	1.4 in
Loading Rate	*	Tensile Strength Offset	0.2 %
Uniform Elongation	*	Tensile Modulus	*
Standard Method	*	Standard Year	*

Test Temp degF	UTS ksi	TYS ksi	TYP ksi	Elongation %	RA %
Room	92.1	63.4	*	28.1	67.3

* - not reported

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Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.2

Description			
Material Code	012.005.09AA	Material Name	A588 GrA
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		
Composition		See Page 9200.1	
Fabrication History		See Page 9200.1	
Weld			
Weld Code	012.005.09AA	Weld Type	SMA
Base Metal Thickness	1 in	Welding Position	IG
Preheat Temperature	50 degF	Metal Gap	0 in
Interpass Temperature	330 degF	Passes	19
Filler Specification	E8018C-2	Filler Name	*
Filler Carbon Content	*	Filler Metal Size	*
Shielding Gas	*	Voltage	*
Amperage	*	Polarity	*
Travel Speed	*	Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove	Number of Sides	2
Location wrt Weld	11mm in HAZ	Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		
Property Measurements			
Test Type	Charpy V Impact	Position	3/4T
Specimen Type	Full	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-150	15	17	20
L-T ◦	-125	14	12	40
L-T ◦	-125	20	17	40
L-T ◦	-100	25	19	40
L-T ◦	-100	29	29	45
L-T ◦	-75	30	28	45
L-T ◦	-75	42	33	50
L-T ◦	-50	38	33	60
L-T ◦	-50	48	40	65
L-T ◦	0	51	50	80
L-T ◦	0	54	46	80
L-T ◦	75	60	56	98
L-T ◦	75	65	66	98
L-T ◦	125	62	59	78
L-T ◦	125	71	72	78

* - not reported

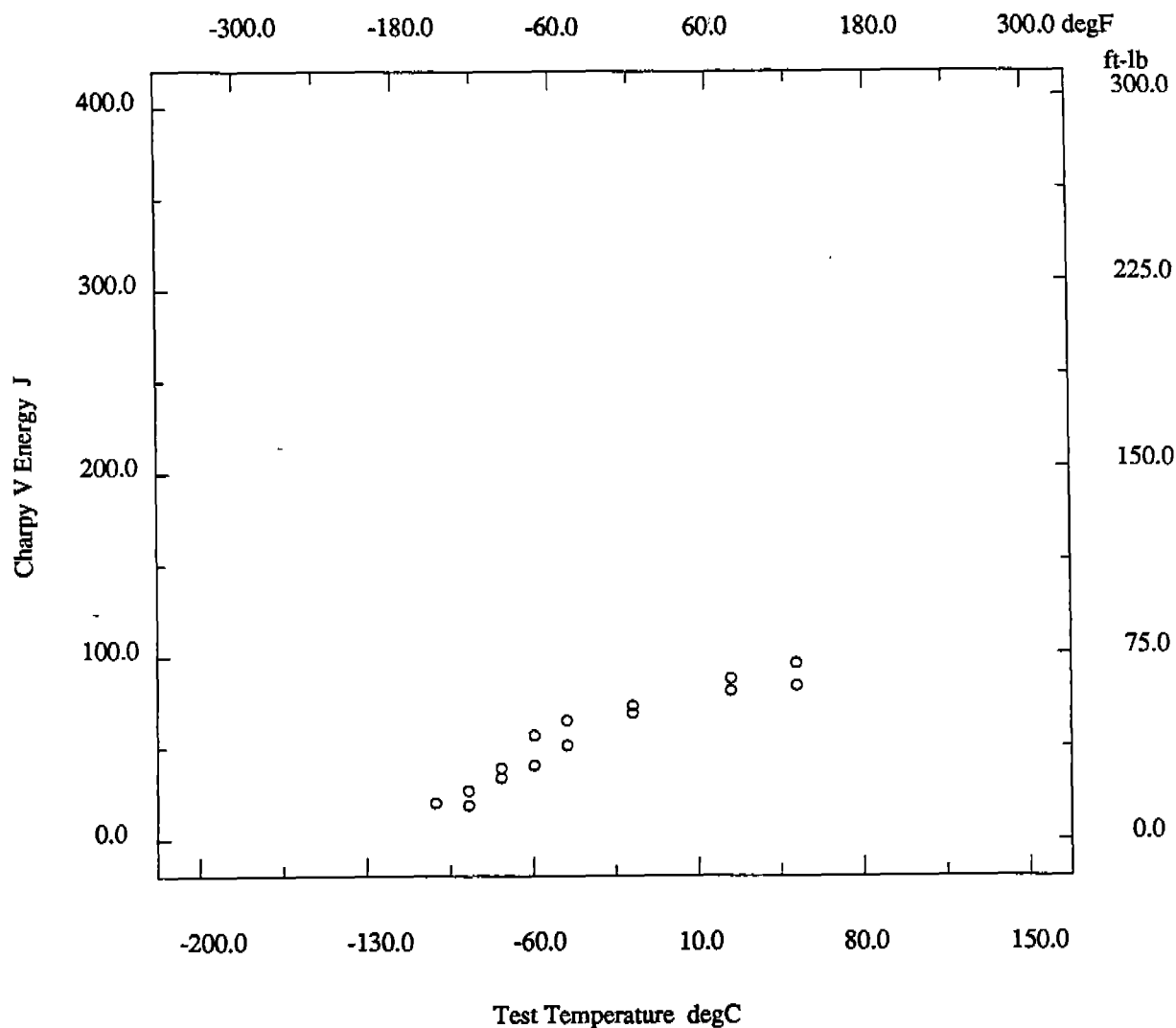
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Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.3

Description			
Material Code	012.005.09AA	Material Name	A588 GrA
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported



Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.4

Description			
Material Code	012.005.02AA	Material Name	A588 GrA
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		

Composition See Page 9200.1

Fabrication History See Page 9200.1

Weld			
Weld Code	012.005.02AA	Weld Type	SMA
Base Metal Thickness	1 in	Welding Position	IG
Preheat Temperature	50 degF	Metal Gap	0 in
Interpass Temperature	330 degF	Passes	19
Filler Specification	E8018C-2	Filler Name	*
Filler Carbon Content	*	Filler Metal Size	*
Shielding Gas	*	Voltage	*
Amperage	*	Polarity	*
Travel Speed	*	Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove	Number of Sides	2
Location wrt Weld	Fusion line	Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		

Property Measurements			
Test Type	Charpy V Impact	Position	3/4T
Specimen Type	Full	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◊	-100	11	6	10
L-T ◊	-100	15	9	20
L-T ◊	-75	21	15	40
L-T ◊	-75	25	14	45
L-T ◊	-50	24	21	50
L-T ◊	-50	30	24	50
L-T ◊	0	39	24	60
L-T ◊	0	58	32	60
L-T ◊	75	57	40	98
L-T ◊	75	80	47	98
L-T ◊	125	48	34	98
L-T ◊	125	78	45	98

* - not reported

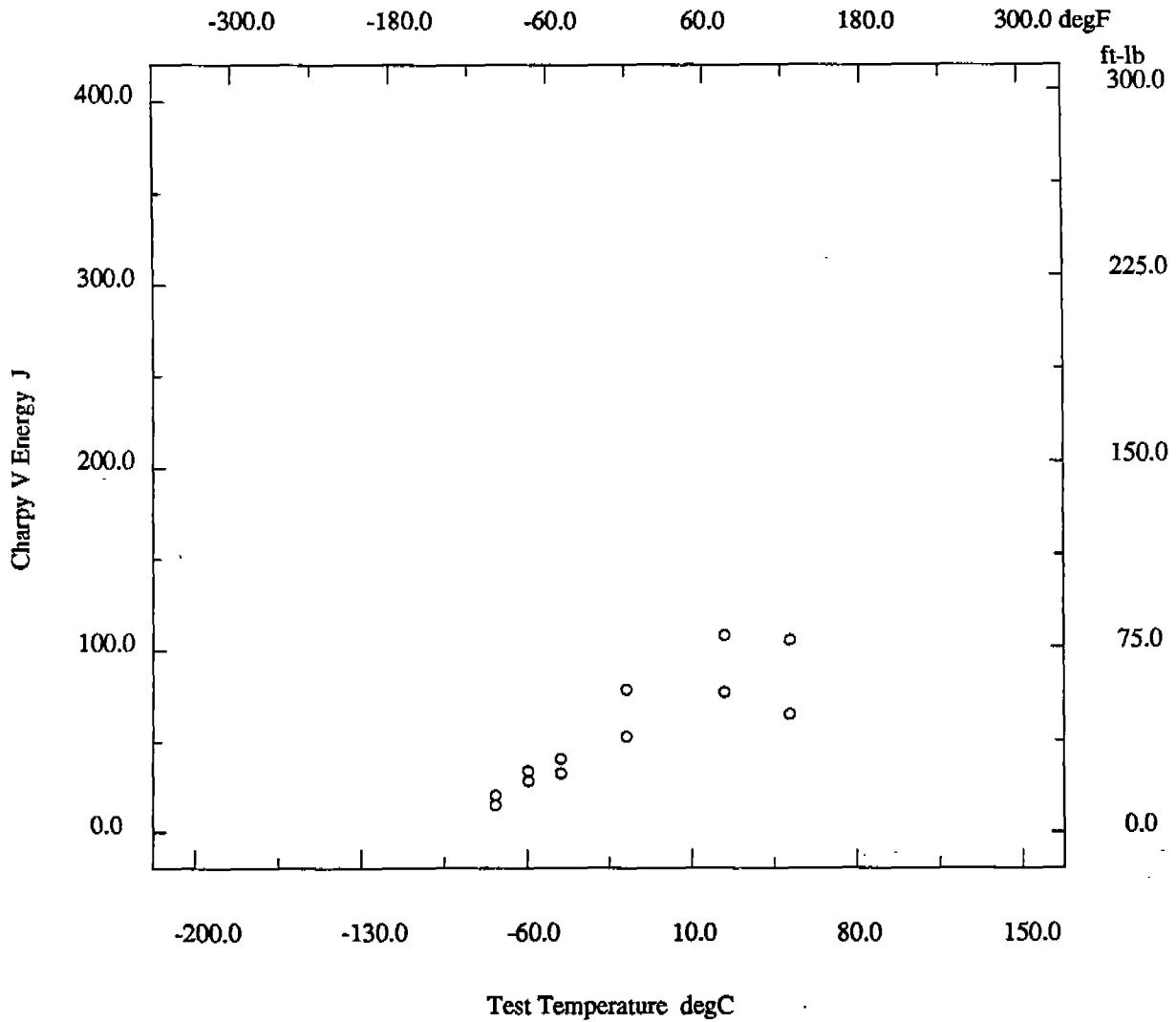
1986

Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.5

Description			
Material Code	012.005.02AA	Material Name	A588 GrA
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.6

Description	
Material Code	012.005.09AS1
Material Name	A588 GrA
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 9200.1

Fabrication History See Page 9200.1

Weld	
Weld Code	012.005.09AS1
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	330 degF
Passes	19
Filler Specification	E8018C-2
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	11mm in HAZ
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	1100 degF
Post-Weld Heat Time	1 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-150	10	8	10
L-T ◦	-150	15	9	10
L-T ◦	-125	14	15	20
L-T ◦	-100	23	21	40
L-T ◦	-100	29	25	40
L-T ◦	-75	25	24	40
L-T ◦	-75	32	28	45
L-T ◦	-50	30	41	40
L-T ◦	-50	45	35	50
L-T ◦	0	65	56	70
L-T ◦	0	68	56	70
L-T ◦	75	74	65	98
L-T ◦	75	76	72	98
L-T ◦	125	72	70	98
L-T ◦	125	86	82	98

* - not reported

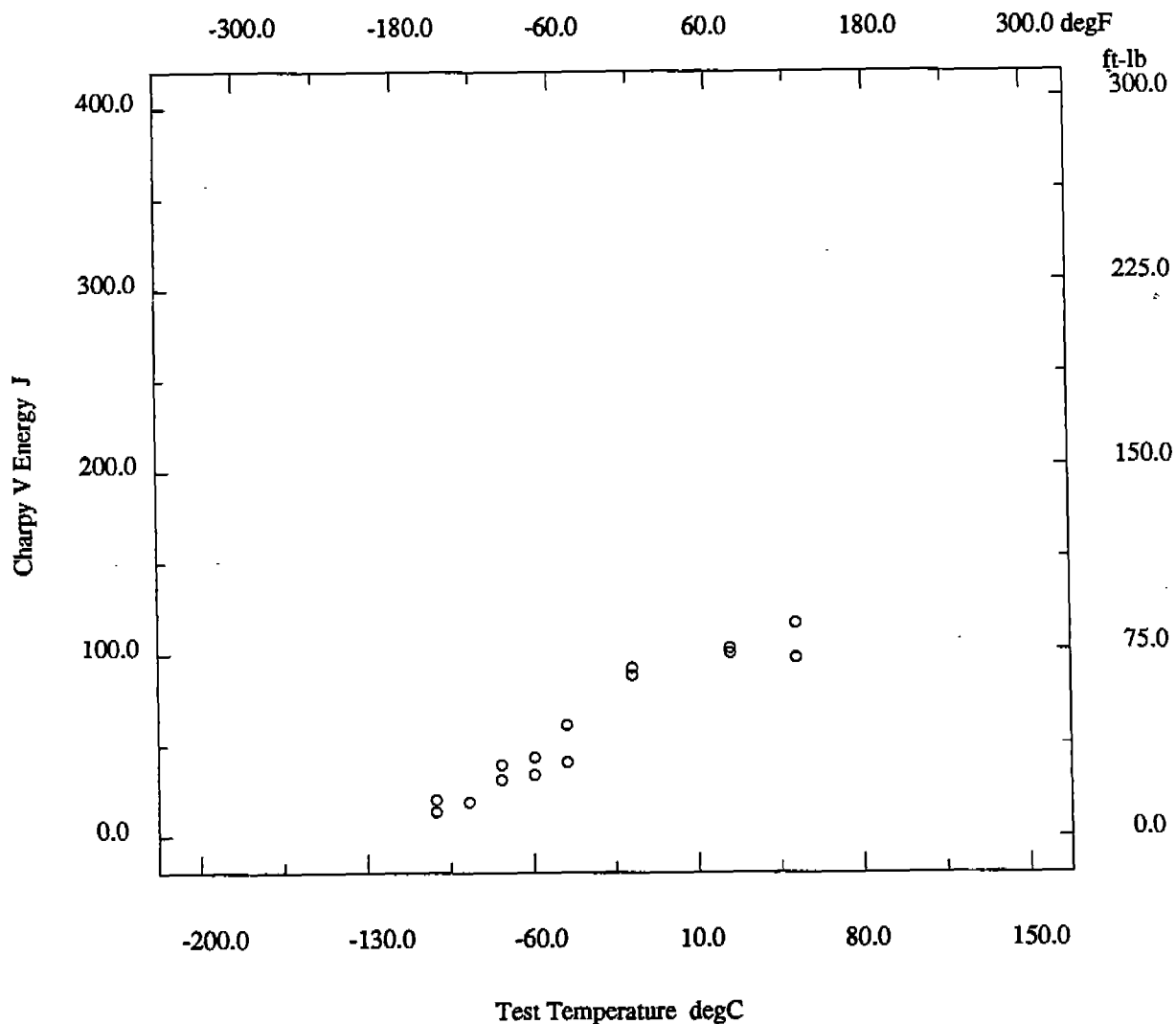


Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.7

Description			
Material Code	012.005.09AS1	Material Name	A588 GrA
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.8

Description	
Material Code 012.005.02AS1	Material Name A588 GrA
UNS *	Other Designation *
Type Welded Joint	Form Plate
Thickness 1 in	Composition Type Actual
Composition Position *	Lot ID *
Reference KONKUL-1	

Composition See Page 9200.1

Fabrication History See Page 9200.1

Weld	
Weld Code 012.005.02AS1	Weld Type SMA
Base Metal Thickness 1 in	Welding Position IG
Preheat Temperature 50 degF	Metal Gap 0 in
Interpass Temperature 330 degF	Passes 19
Filler Specification E8018C-2	Filler Name *
Filler Carbon Content *	Filler Metal Size *
Shielding Gas *	Voltage *
Amperage *	Polarity *
Travel Speed *	Heat Input/Pass 34 KJ/in
Joint Preparation K-Groove	Number of Sides 2
Location wrt Weld Fusion line	Location wrt Surface Mid thickness at root
Post-Weld Heat Temp 1100 degF	Post-Weld Heat Time 1 hr
Flux Type *	Flux Name *
Weld Composition Reported? No	

Property Measurements	
Test Type Charpy V Impact	Position 3/4T
Specimen Type Full	Did Specimen Fracture? Assumed
Did Specimen Split? *	Standard Method *
Standard Year *	

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-125	7	2	5
L-T ◦	-75	19	12	35
L-T ◦	-75	20	11	30
L-T ◦	-50	19	15	40
L-T ◦	-50	22	16	45
L-T ◦	-25	27	14	50
L-T ◦	-25	42	26	50
L-T ◦	0	47	30	60
L-T ◦	0	52	34	70
L-T ◦	75	39	31	90
L-T ◦	75	45	33	95
L-T ◦	100	46	45	95
L-T ◦	100	48	40	95
L-T ◦	125	43	35	98
L-T ◦	125	67	61	98

* - not reported

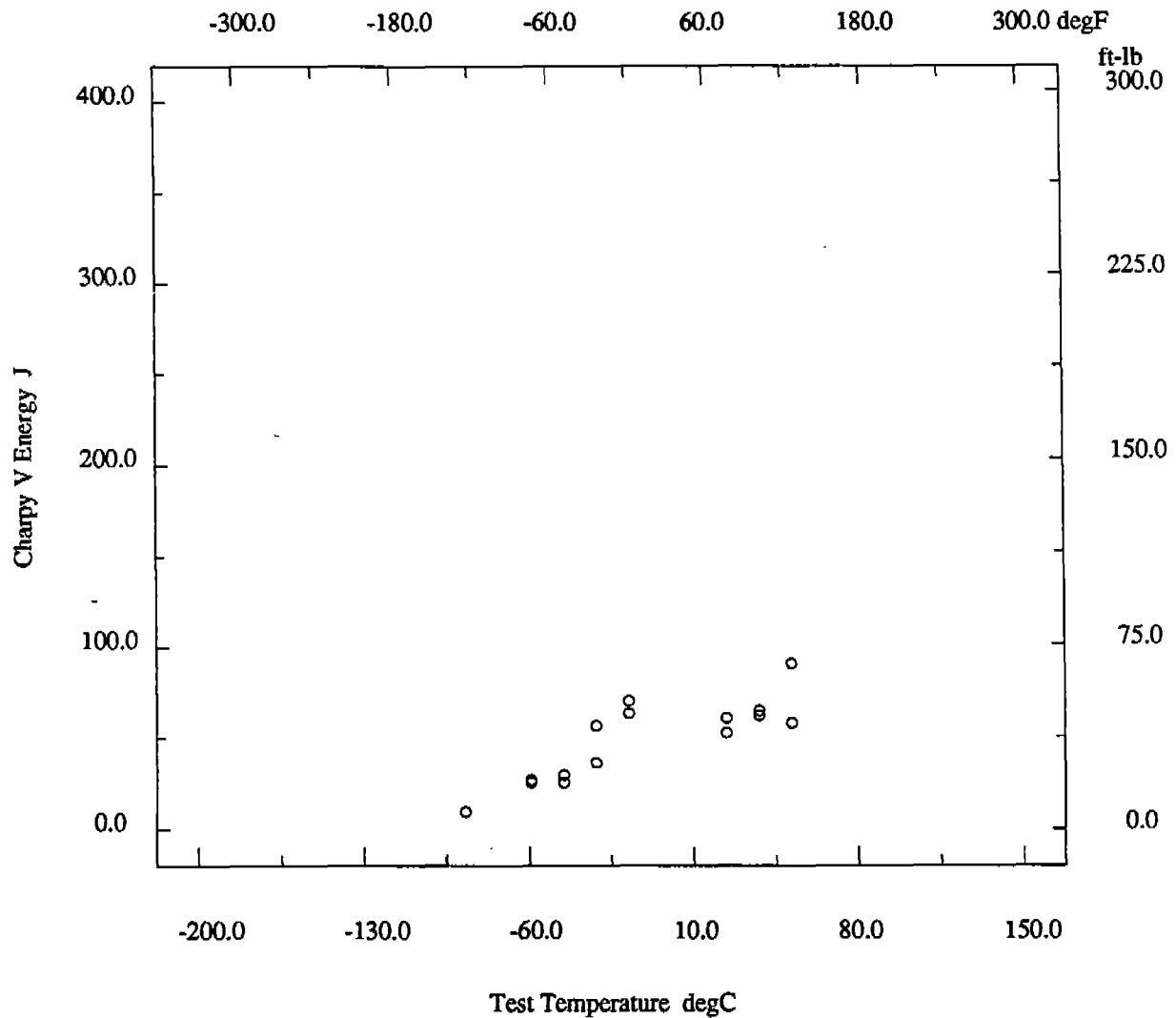
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Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.9

Description			
Material Code	012.005.02AS1	Material Name	A588 GrA
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.10

Description	
Material Code	012.005.09AS2
Material Name	A588 GrA
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 9200.1

Fabrication History See Page 9200.1

Weld	
Weld Code	012.005.09AS2
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	330 degF
Passes	19
Filler Specification	E8018C-2
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	11mm in HAZ
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	1100 degF
Post-Weld Heat Time	5 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-125	17	18	25
L-T ◦	-125	24	24	25
L-T ◦	-100	38	22	25
L-T ◦	-100	41	33	30
L-T ◦	-75	24	26	35
L-T ◦	-75	38	33	45
L-T ◦	-50	42	44	45
L-T ◦	-50	43	43	45
L-T ◦	-25	53	47	60
L-T ◦	-25	60	58	75
L-T ◦	0	71	60	75
L-T ◦	0	74	57	70
L-T ◦	25	78	67	95
L-T ◦	25	88	73	100

* - not reported

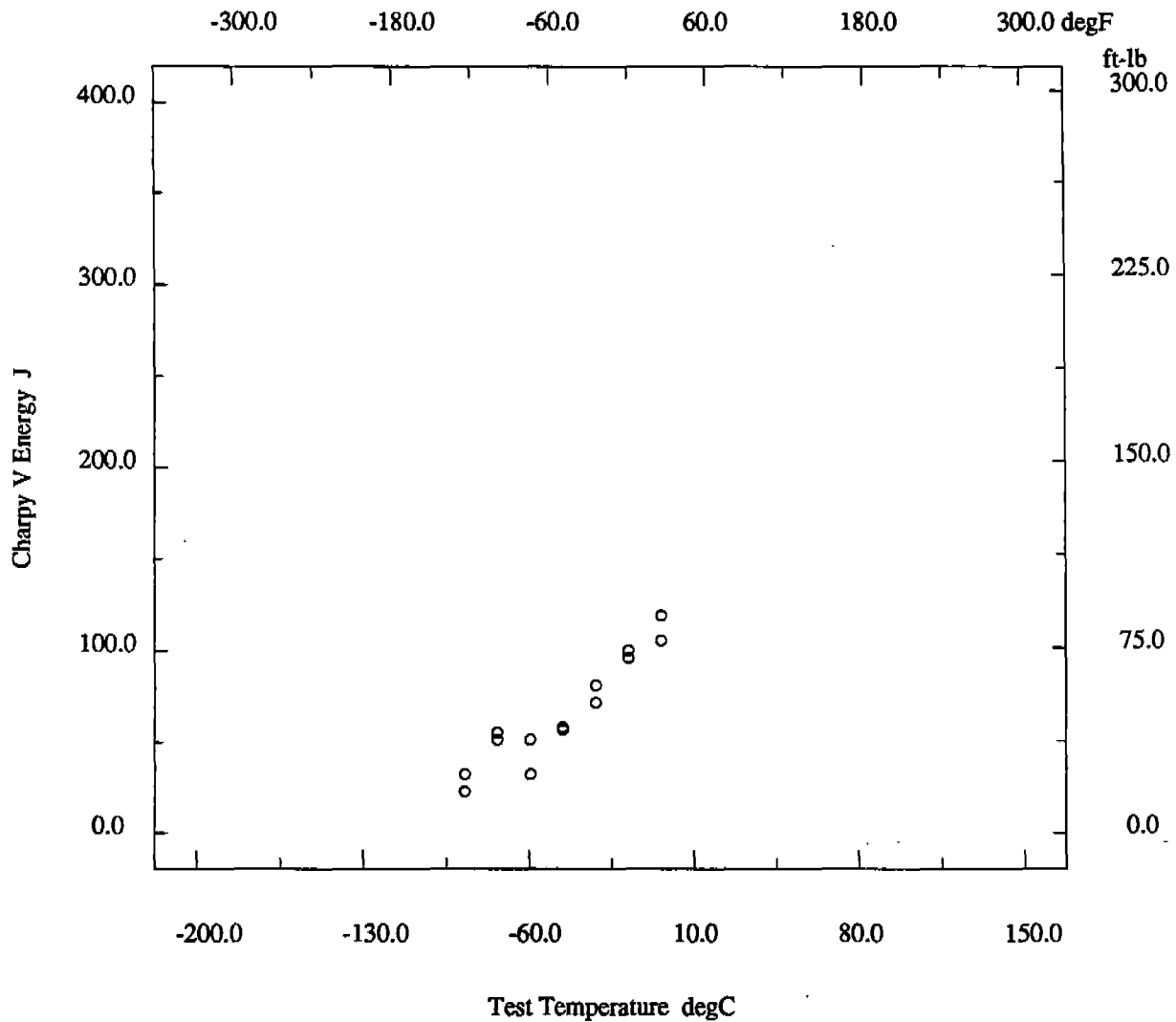
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Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.11

Description			
Material Code	012.005.09AS2	Material Name	A588 GrA
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.12

Description	
Material Code 012.005.02AS2	Material Name A588 GrA
UNS *	Other Designation *
Type Welded Joint	Form Plate
Thickness 1 in	Composition Type Actual
Composition Position *	Lot ID *
Reference KONKUL-1	
Composition	See Page 9200.1
Fabrication History	See Page 9200.1
Weld	
Weld Code 012.005.02AS2	Weld Type SMA
Base Metal Thickness 1 in	Welding Position IG
Preheat Temperature 50 degF	Metal Gap 0 in
Interpass Temperature 330 degF	Passes 19
Filler Specification E8018C-2	Filler Name *
Filler Carbon Content *	Filler Metal Size *
Shielding Gas *	Voltage *
Amperage *	Polarity *
Travel Speed *	Heat Input/Pass 34 KJ/in
Joint Preparation K-Groove	Number of Sides 2
Location wrt Weld Fusion line	Location wrt Surface Mid thickness at root
Post-Weld Heat Temp 1100 degF	Post-Weld Heat Time 5 hr
Flux Type *	Flux Name *
Weld Composition Reported? No	
Property Measurements	
Test Type Charpy V Impact	Position 3/4T
Specimen Type Full	Did Specimen Fracture? Assumed
Did Specimen Split? *	Standard Method *
Standard Year *	

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-100	11	10	20
L-T ◦	-100	18	18	20
L-T ◦	-75	16	11	25
L-T ◦	-75	16	14	30
L-T ◦	-50	25	22	45
L-T ◦	-50	26	24	40
L-T ◦	-50	34	28	50
L-T ◦	-25	25	22	35
L-T ◦	-25	27	25	35
L-T ◦	0	47	35	75
L-T ◦	0	48	39	60
L-T ◦	25	70	52	95
L-T ◦	25	73	50	60
L-T ◦	50	60	46	85
L-T ◦	50	85	58	100

* - not reported

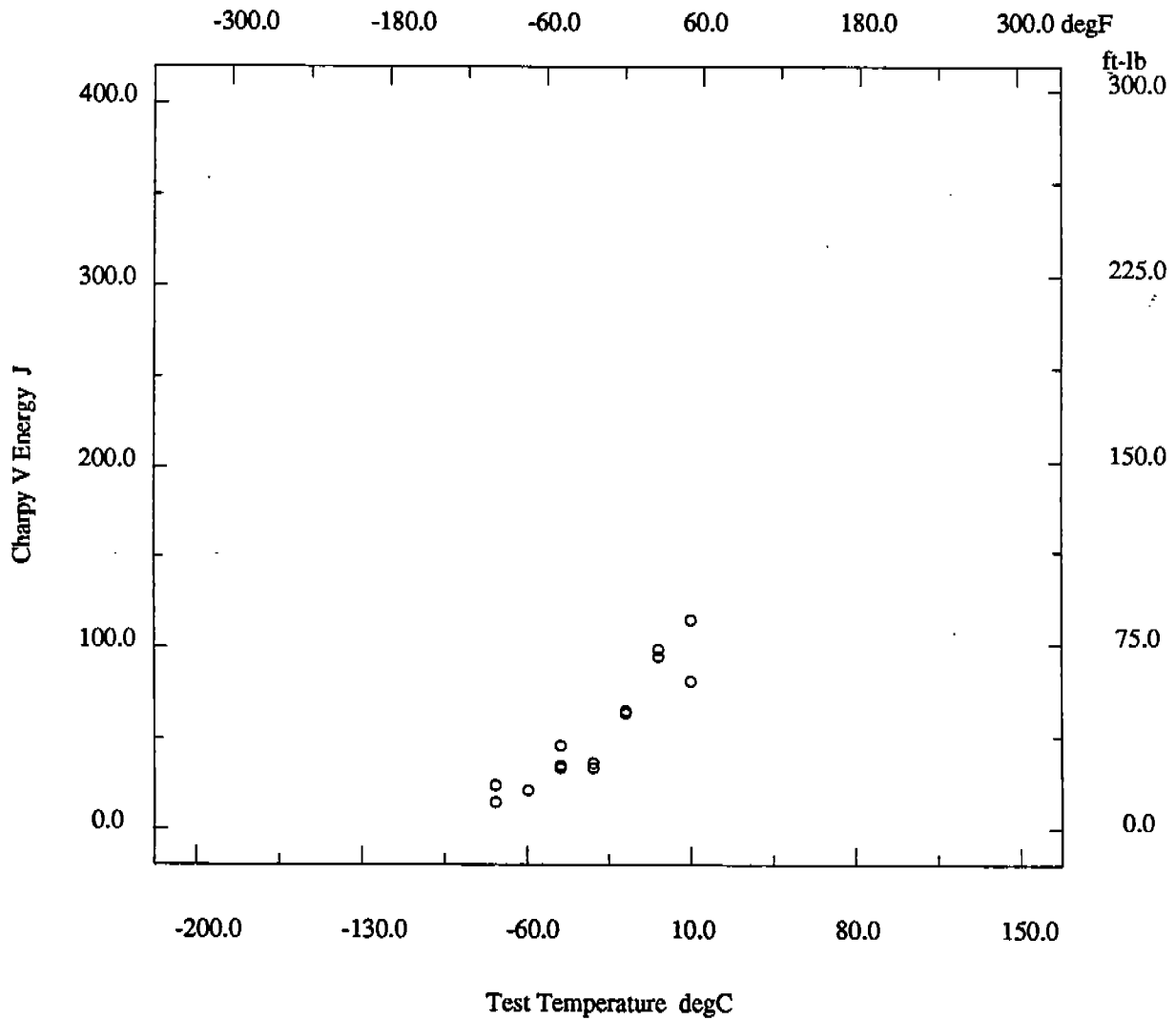


Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.13

Description			
Material Code	012.005.02AS2	Material Name	A588 GrA
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported



Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.14

Description	
Material Code	012.005.09AS3
Material Name	A588 GrA
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 9200.1

Fabrication History See Page 9200.1

Weld	
Weld Code	012.005.09AS3
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	330 degF
Passes	19
Filler Specification	E8018C-2
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	11mm in HAZ
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	1200 degF
Post-Weld Heat Time	1 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-150	4	6	10
L-T ◦	-150	7	10	10
L-T ◦	-125	15	17	20
L-T ◦	-125	17	19	15
L-T ◦	-100	27	27	30
L-T ◦	-100	30	29	25
L-T ◦	-100	37	24	35
L-T ◦	-75	33	30	30
L-T ◦	-75	35	30	30
L-T ◦	-50	43	40	45
L-T ◦	-50	57	55	50
L-T ◦	-25	48	47	60
L-T ◦	-25	60	54	60
L-T ◦	0	74	67	90
L-T ◦	0	78	54	90

* - not reported

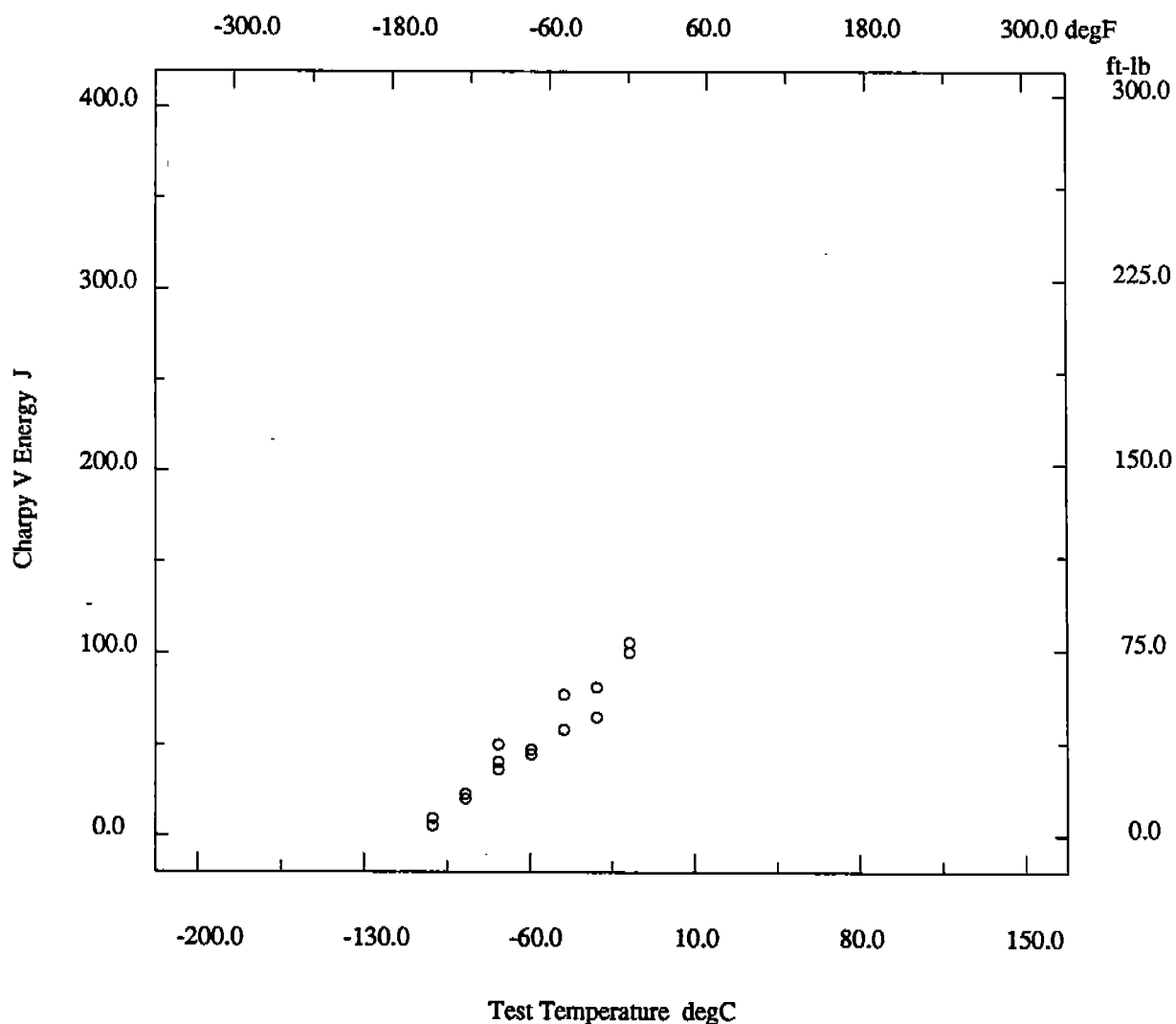
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Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.15

Description	
Material Code	012.005.09AS3
Material Name	A588 GrA
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1



* - not reported



Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.16

Description	
Material Code	012.005.02AS3
Material Name	A588 GrA
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1

Composition See Page 9200.1

Fabrication History See Page 9200.1

Weld	
Weld Code	012.005.02AS3
Weld Type	SMA
Base Metal Thickness	1 in
Welding Position	IG
Preheat Temperature	50 degF
Metal Gap	0 in
Interpass Temperature	330 degF
Passes	19
Filler Specification	E8018C-2
Filler Name	*
Filler Carbon Content	*
Filler Metal Size	*
Shielding Gas	*
Voltage	*
Amperage	*
Polarity	*
Travel Speed	*
Heat Input/Pass	34 KJ/in
Joint Preparation	K-Groove
Number of Sides	2
Location wrt Weld	Fusion line
Location wrt Surface	Mid thickness at root
Post-Weld Heat Temp	1200 degF
Post-Weld Heat Time	1 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◊	-100	16	11	25
L-T ◊	-100	8	10	20
L-T ◊	-75	23	20	40
L-T ◊	-75	34	22	35
L-T ◊	-75	50	32	35
L-T ◊	-50	104	57	60
L-T ◊	-50	26	50	45
L-T ◊	-50	78	53	55
L-T ◊	-25	31	28	55
L-T ◊	-25	76	55	75
L-T ◊	0	58	46	75
L-T ◊	0	76	52	80
L-T ◊	0	80	56	95
L-T ◊	25	80	59	99
L-T ◊	25	97	68	100

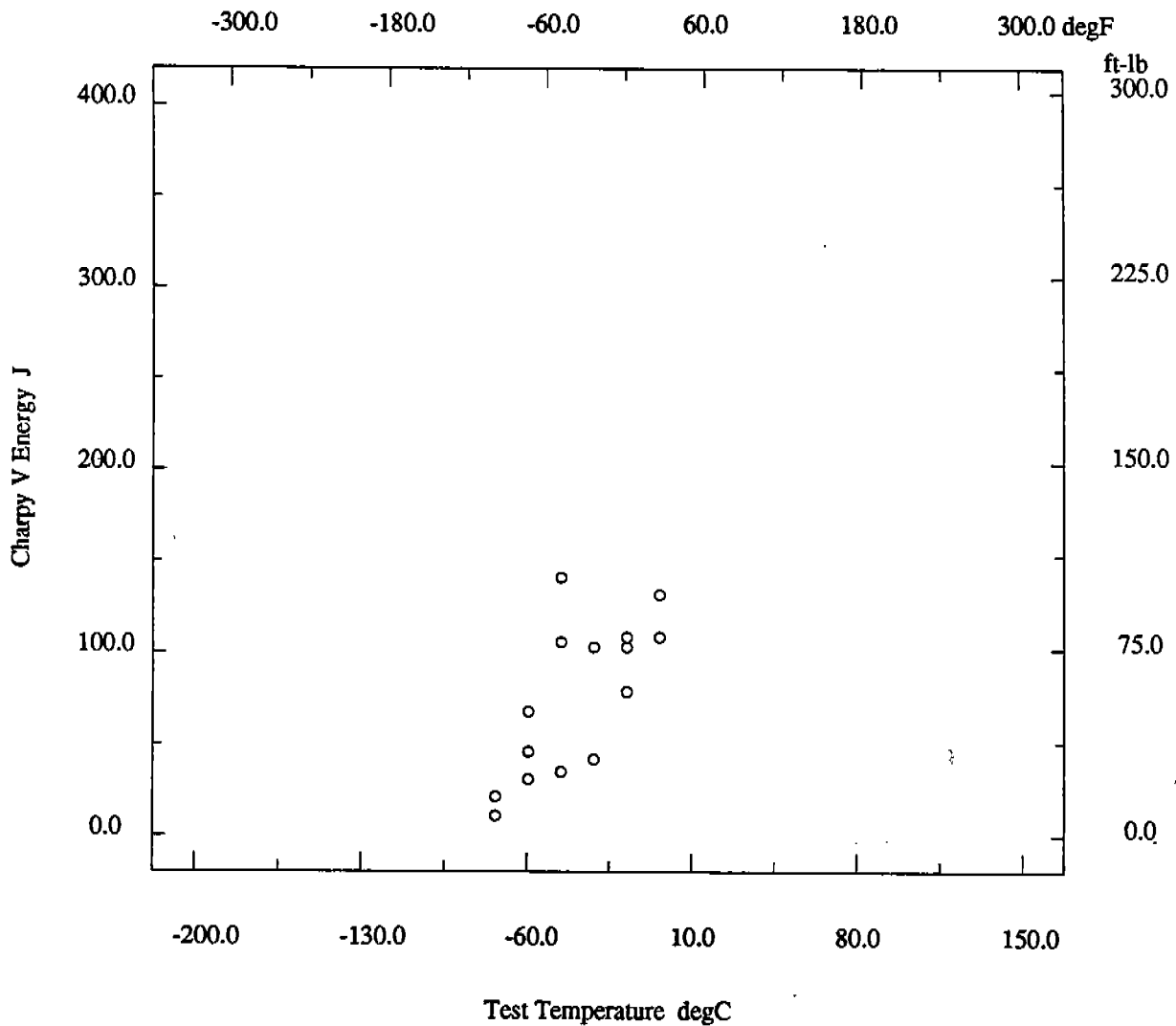
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Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.17

Description	
Material Code	012.005.02AS3
Material Name	A588 GrA
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	1 in
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	KONKUL-1



* - not reported

(2P)

Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.18

Description	
Material Code 012.005.09AS4	Material Name A588 GrA
UNS *	Other Designation *
Type Welded Joint	Form Plate
Thickness 1 in	Composition Type Actual
Composition Position *	Lot ID *
Reference KONKUL-1	
Composition See Page 9200.1	
Fabrication History See Page 9200.1	
Weld	
Weld Code 012.005.09AS4	Weld Type SMA
Base Metal Thickness 1 in	Welding Position IG
Preheat Temperature 50 degF	Metal Gap 0 in
Interpass Temperature 330 degF	Passes 19
Filler Specification E8018C-2	Filler Name *
Filler Carbon Content *	Filler Metal Size *
Shielding Gas *	Voltage *
Amperage *	Polarity *
Travel Speed *	Heat Input/Pass 34 KJ/in
Joint Preparation K-Groove	Number of Sides 2
Location wrt Weld 11mm in HAZ	Location wrt Surface Mid thickness at root
Post-Weld Heat Temp 1200 degF	Post-Weld Heat Time 5 hr
Flux Type *	Flux Name *
Weld Composition Reported? No	
Property Measurements	
Test Type Charpy V Impact	Position 3/4T
Specimen Type Full	Did Specimen Fracture? Assumed
Did Specimen Split? *	Standard Method *
Standard Year *	

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-100	11	13	20
L-T ◦	-100	8	13	15
L-T ◦	-75	18	20	25
L-T ◦	-75	27	30	25
L-T ◦	-50	40	41	50
L-T ◦	-50	46	43	45
L-T ◦	-25	46	46	55
L-T ◦	-25	70	63	75
L-T ◦	0	61	53	70
L-T ◦	0	66	51	80
L-T ◦	0	79	68	85
L-T ◦	25	73	65	85
L-T ◦	25	75	68	85
L-T ◦	50	90	75	98
L-T ◦	50	90	83	98

* - not reported

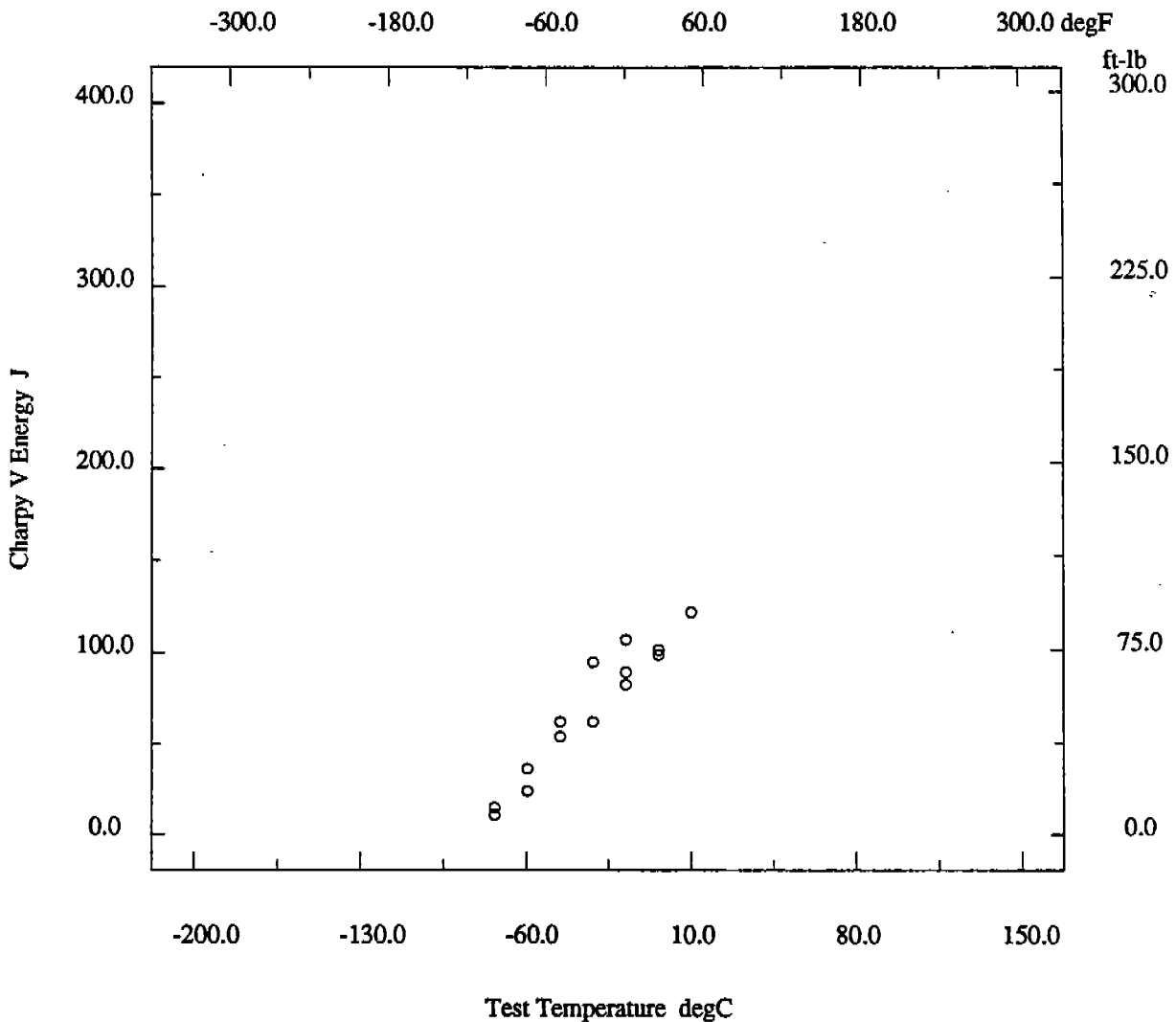
920

Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.19

Description			
Material Code	012.005.09AS4	Material Name	A588 GrA
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.20

Description	
Material Code 012.005.02AS4	Material Name A588 GrA
UNS *	Other Designation *
Type Welded Joint	Form Plate
Thickness 1 in	Composition Type Actual
Composition Position *	Lot ID *
Reference KONKUL-1	
Composition	See Page 9200.1
Fabrication History	See Page 9200.1
Weld	
Weld Code 012.005.02AS4	Weld Type SMA
Base Metal Thickness 1 in	Welding Position IG
Preheat Temperature 50 degF	Metal Gap 0 in
Interpass Temperature 330 degF	Passes 19
Filler Specification E8018C-2	Filler Name *
Filler Carbon Content *	Filler Metal Size *
Shielding Gas *	Voltage *
Amperage *	Polarity *
Travel Speed *	Heat Input/Pass 34 KJ/in
Joint Preparation K-Groove	Number of Sides 2
Location wrt Weld Fusion line	Location wrt Surface Mid thickness at root
Post-Weld Heat Temp 1200 degF	Post-Weld Heat Time 5 hr
Flux Type *	Flux Name *
Weld Composition Reported? No	
Property Measurements	
Test Type Charpy V Impact	Position 3/4T
Specimen Type Full	Did Specimen Fracture? Assumed
Did Specimen Split? *	Standard Method *
Standard Year *	

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◦	-125	10	12	15
L-T ◦	-125	11	11	10
L-T ◦	-100	18	13	25
L-T ◦	-100	18	15	30
L-T ◦	-100	31	22	25
L-T ◦	-75	32	30	45
L-T ◦	-75	33	24	40
L-T ◦	-75	46	27	35
L-T ◦	-50	72	52	80
L-T ◦	-50	73	51	75
L-T ◦	-50	77	53	65
L-T ◦	-25	76	54	75
L-T ◦	-25	86	56	80
L-T ◦	0	82	55	90
L-T ◦	0	89	66	100

* - not reported

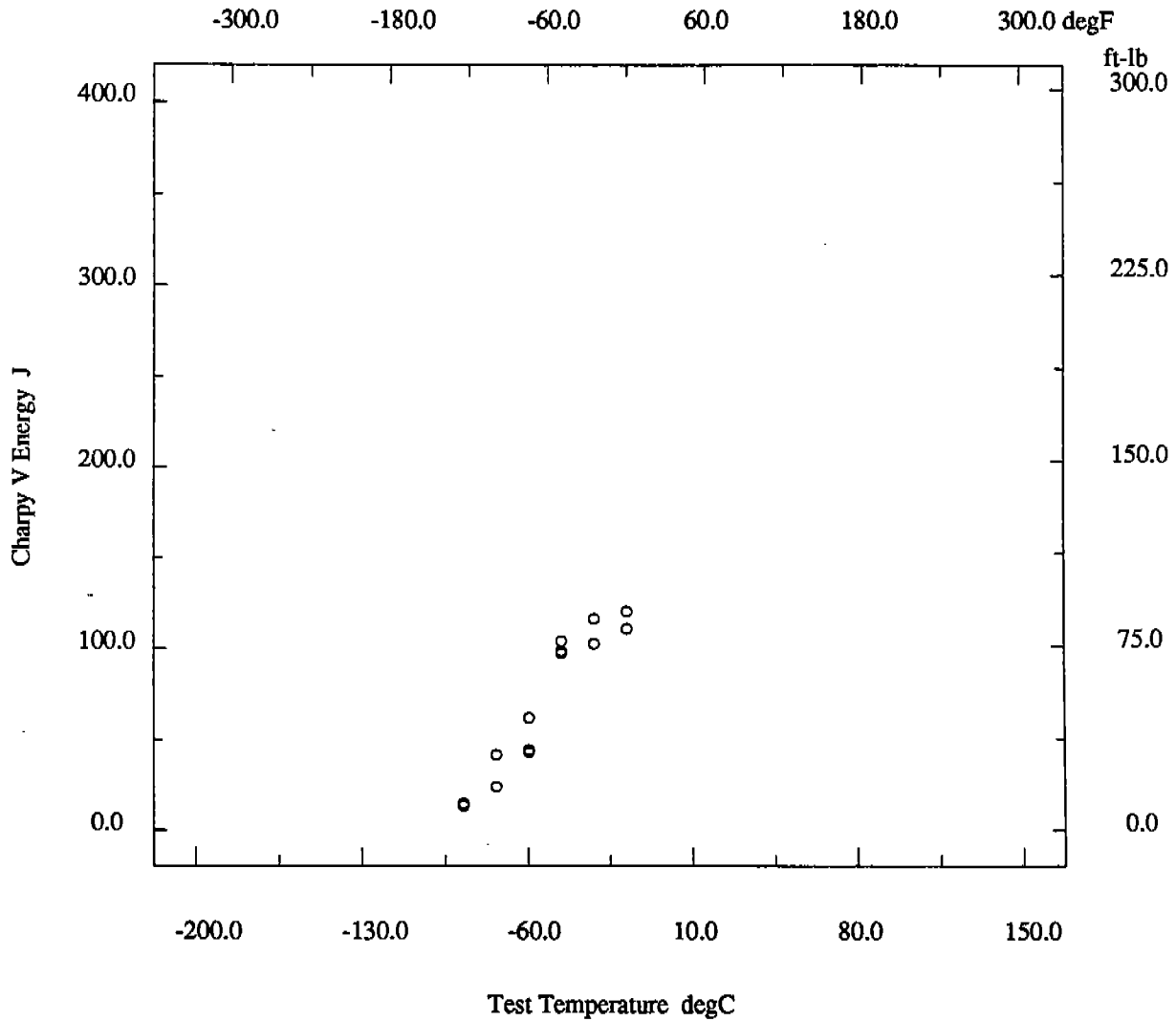
202

Marine Structural Toughness Data Bank

Material A588 GrA

Page 9200.21

Description			
Material Code	012.005.02AS4	Material Name	A588 GrA
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	1 in	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	KONKUL-1		



* - not reported

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Marine Structural Toughness Data Bank

Material A710

Page 9400.1

Description						
Material Code	002.001.01A1	Material Name	A710			
UNS	*	Other Designation	Class 1			
Type	Wrought Metal	Form	Plate			
Thickness	5/16 in	Composition Type	Actual			
Composition Position	*	Lot ID	57221			
Reference	*					
Composition						
C	0.04 %	Mn	0.50 %			
P	0.01 %	S	0.01 %			
Si	0.28 %	Cr	0.73 %			
Ni	0.91 %	Mo	0.20 %			
V	*	Cu	1.24 %			
Cb	0.03 %	Ti	*			
B	*	Al	*			
N	*	Other Components	*			
Fabrication History						
Heat Treatment	Q,K	Producer	*			
Year Produced	*	Addl Info	None			
Source	*	Melting Practice	*			
Ingot Position	*	Killing Process	*			
Process Temperature	*	Process Time	*			
Rolling Conditions	*	Final Processing	K			
Final Temperature	1100 degF	Final Time	*			
Cold Work Strain	*	Aging Temperature	*			
Aging Time	*	Location	*			
Property Measurements						
Test Type	Tensile	Position	*			
Specimen Type	*	Specimen Thickness	5/16 in			
Gage Length	8 in	Loading Rate	*			
Tensile Strength Offset	*	Uniform Elongation	*			
Tensile Modulus	*	Standard Method	*			
Standard Year	*					
Orient	Test Temp	UTS	TYS	TYP	Elongation	RA
	degF	ksi	ksi	ksi	%	%
T	Room	101	90.5	*	18	*

* - not reported

Marine Structural Toughness Data Bank

Material A710

Page 9400.2

Description	
Material Code	002.001.01A1
Material Name	A710
UNS	*
Other Designation	Class 1
Type	Wrought Metal
Form	Plate
Thickness	5/16 in
Composition Type	Actual
Composition Position	*
Lot ID	57221
Reference	*

Composition See Page 9400.1

Fabrication History See Page 9400.1

Property Measurements	
Test Type	Charpy V Impact
Position	*
Specimen Type	2/3
Shear Fracture	*
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils
L-T ◯	-50	75	77
L-T ◯	-50	76	81
L-T ◯	-50	82	83
T-L ▲	-50	23	32
T-L ▲	-50	24	32
T-L ▲	-50	25	35

* - not reported

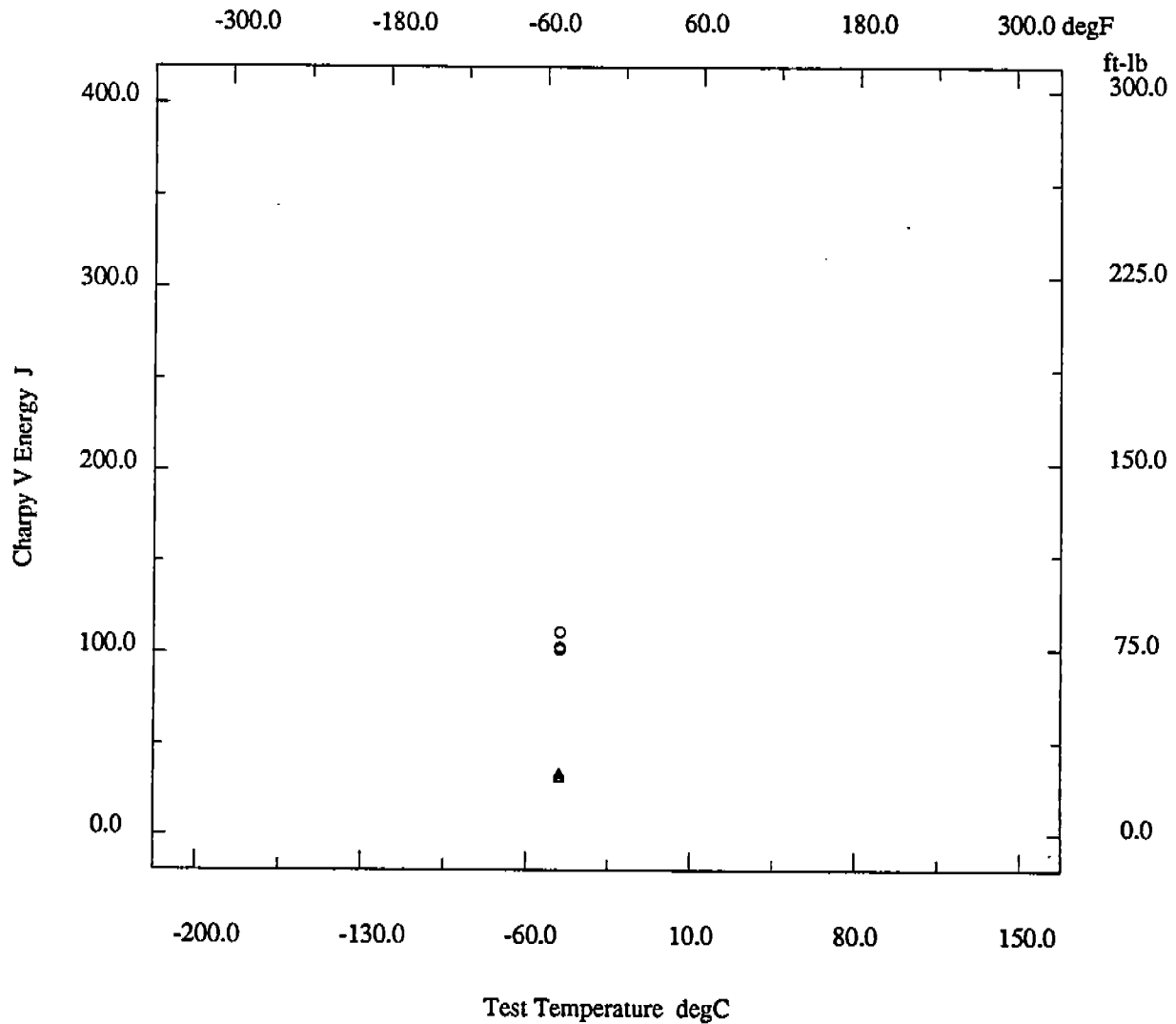
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Marine Structural Toughness Data Bank

Material A710

Page 9400.3

Description			
Material Code	002.001.01A1	Material Name	A710
UNS	*	Other Designation	Class 1
Type	Wrought Metal	Form	Plate
Thickness	5/16 in	Composition Type	Actual
Composition Position	*	Lot ID	57221
Reference	*		



* - not reported

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2/15 X

Marine Structural Toughness Data Bank

Material A710

Page 9500.1

Description	
Material Code	002.001.01B1
Material Name	A710
UNS	*
Other Designation	Class 2
Type	Wrought Metal
Form	Plate
Thickness	3/8 in
Composition Type	Actual
Composition Position	*
Lot ID	57221
Reference	*

Composition			
C	0.04 %	Mn	0.50 %
P	0.01 %	S	0.01 %
Si	0.28 %	Cr	0.73 %
Ni	0.91 %	Mo	0.20 %
V	*	Cu	1.24 %
Cb	0.03 %	Ti	*
B	*	Al	*
N	*	Other Components	*

Fabrication History			
Heat Treatment	Q,K	Producer	*
Year Produced	*	Addl Info	None
Source	*	Melting Practice	*
Ingot Position	*	Killing Process	*
Process Temperature	*	Process Time	*
Rolling Conditions	*	Final Processing	K
Final Temperature	1200 degF	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Tensile	Position	*
Specimen Type	*	Specimen Thickness	3/8 in
Gage Length	2 in	Loading Rate	*
Tensile Strength Offset	*	Uniform Elongation	*
Tensile Modulus	*	Standard Method	*
Standard Year	*		

Orient	Test Temp degF	UTS ksi	TYS ksi	TYP ksi	Elongation %	RA %
T	Room	74.5	70.1	*	28	*

* - not reported



Marine Structural Toughness Data Bank

Material A710

Page 9500.2

Description	
Material Code 002.001.01B1	Material Name A710
UNS *	Other Designation Class 2
Type Wrought Metal	Form Plate
Thickness 3/8 in	Composition Type Actual
Composition Position *	Lot ID 57221
Reference *	
Composition	See Page 9500.1
Fabrication History	See Page 9500.1
Property Measurements	
Test Type Charpy V Impact	Position *
Specimen Type 3/4	Shear Fracture *
Did Specimen Fracture? Assumed	Did Specimen Split? *
Standard Method *	Standard Year *

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils
L-T ◦	-50	194	78
L-T ◦	-50	198	85
L-T ◦	-50	200	90

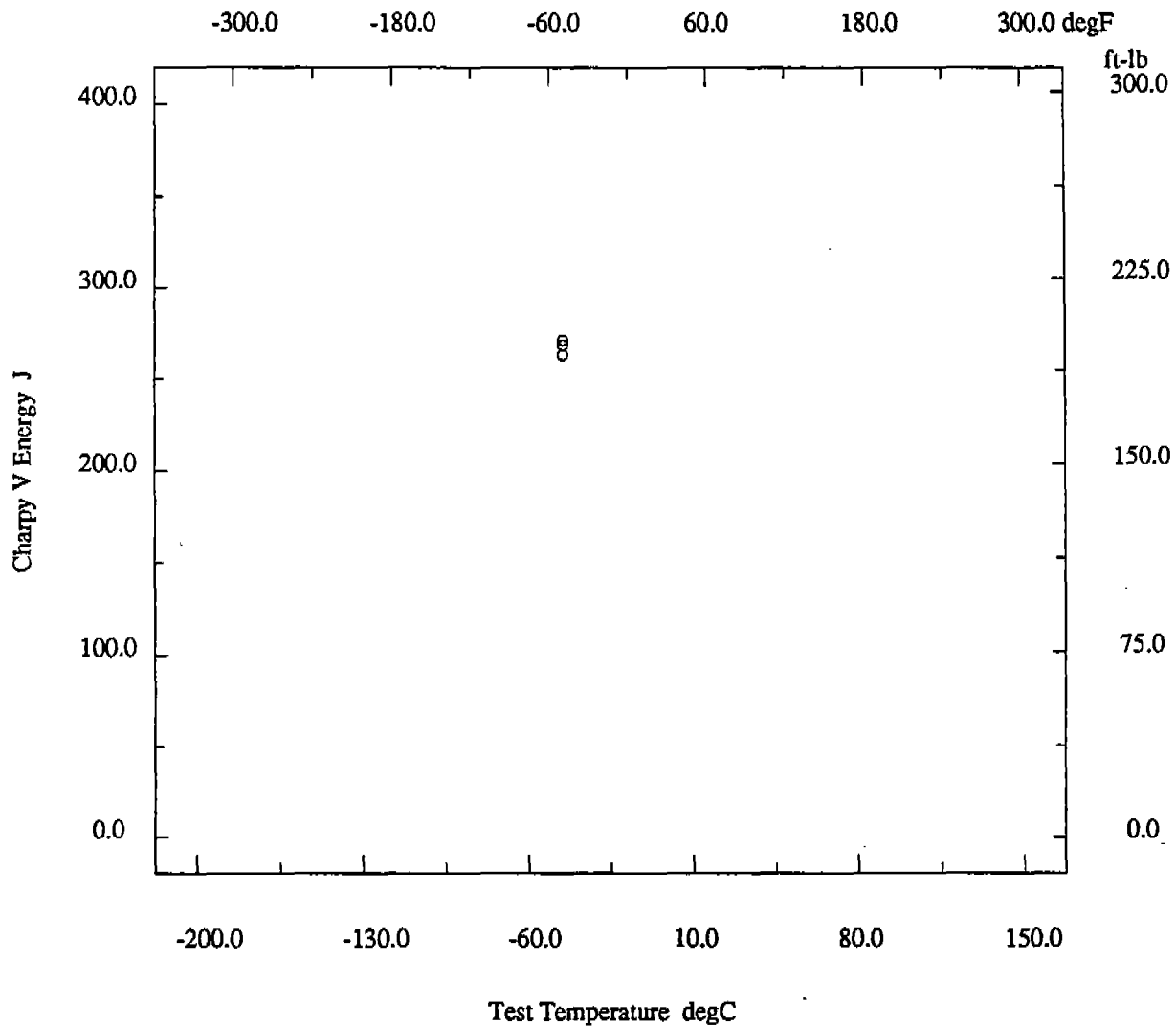
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Marine Structural Toughness Data Bank

Material A710

Page 9500.3

Description			
Material Code	002.001.01B1	Material Name	A710
UNS	*	Other Designation	Class 2
Type	Wrought Metal	Form	Plate
Thickness	3/8 in	Composition Type	Actual
Composition Position	*	Lot ID	57221
Reference	*		



* - not reported

57221

Marine Structural Toughness Data Bank

Material A710

Page 9500.4

Description						
Material Code	002.001.01B2	Material Name	A710			
UNS	*	Other Designation	Class 2			
Type	Wrought Metal	Form	Plate			
Thickness	4 in	Composition Type	Actual			
Composition Position	*	Lot ID	57221			
Reference	*					
Composition		See Page 9500.1				
Fabrication History						
Heat Treatment	Q,K	Producer	*			
Year Produced	*	Addl Info	None			
Source	*	Melting Practice	*			
Ingot Position	*	Killing Process	*			
Process Temperature	*	Process Time	*			
Rolling Conditions	*	Final Processing	K			
Final Temperature	1100 degF	Final Time	*			
Cold Work Strain	*	Aging Temperature	*			
Aging Time	*	Location	*			
Property Measurements						
Test Type	Tensile	Position	*			
Specimen Type	*	Specimen Thickness	4 in			
Gage Length	2 in	Loading Rate	*			
Tensile Strength Offset	*	Uniform Elongation	*			
Tensile Modulus	*	Standard Method	*			
Standard Year	*					
Orient	Test Temp	UTS	TYS	TYP	Elongation	RA
	degF	ksi	ksi	ksi	%	%
T	Room	79.7	61.9	*	30	*

* - not reported

Marine Structural Toughness Data Bank

Material A710

Page 9500.5

Description	
Material Code	002.001.01B2
Material Name	A710
UNS	*
Other Designation	Class 2
Type	Wrought Metal
Form	Plate
Thickness	4 in
Composition Type	Actual
Composition Position	*
Lot ID	57221
Reference	*

Composition See Page 9500.1

Fabrication History See Page 9500.4

Property Measurements	
Test Type	Charpy V Impact
Position	*
Specimen Type	3/4
Shear Fracture	*
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils
L-T ◦	-50	135	92
L-T ◦	-50	140	94
L-T ◦	-50	144	96

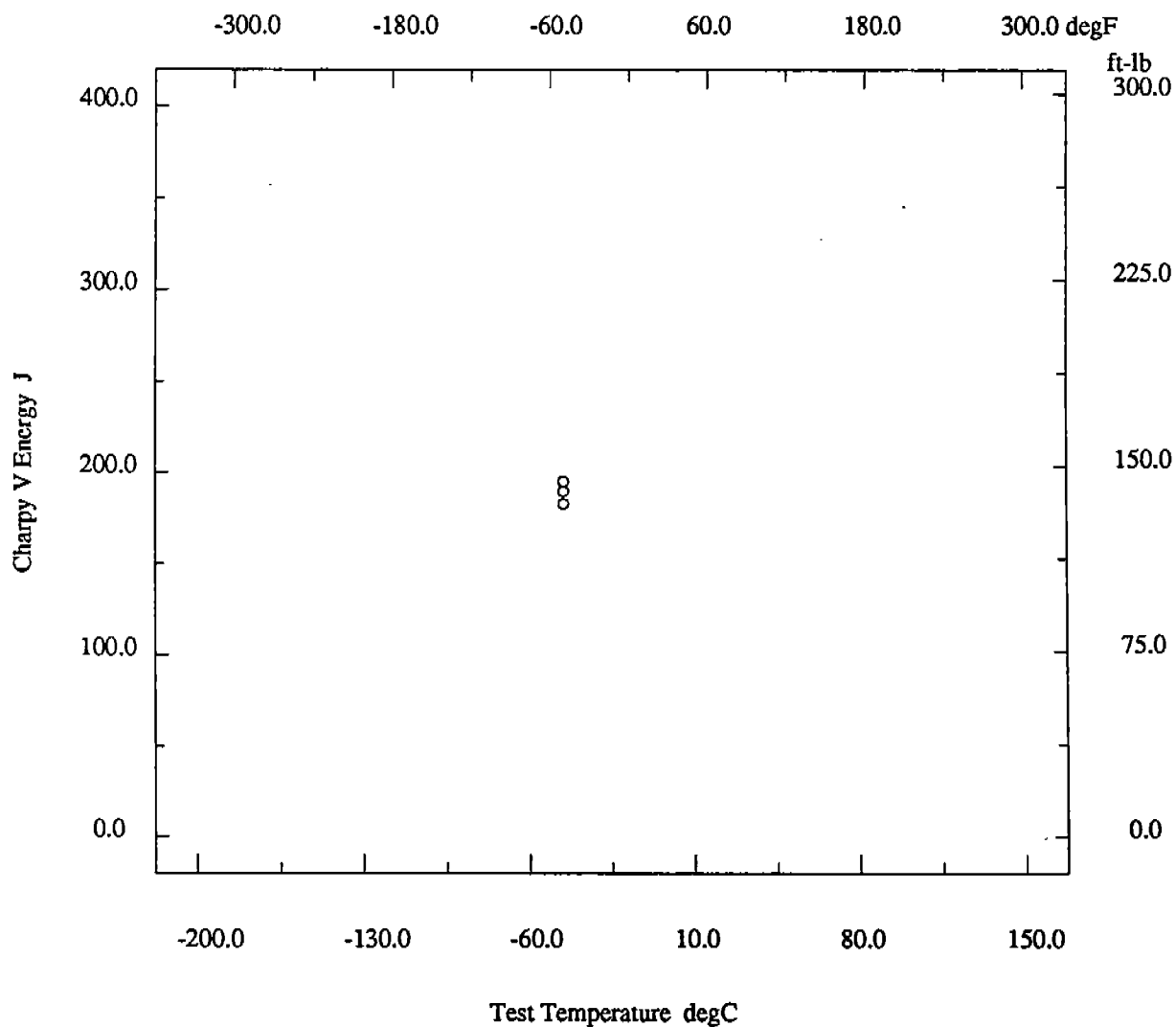
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Marine Structural Toughness Data Bank

Material A710

Page 9500.6

Description	
Material Code	002.001.01B2
UNS	*
Type	Wrought Metal
Thickness	4 in
Composition Position	*
Reference	*
Material Name	A710
Other Designation	Class 2
Form	Plate
Composition Type	Actual
Lot ID	57221



* - not reported

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Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.1

Description	
Material Code	010.001.010S
Material Name	BS4360 Gr50D
UNS	*
Other Designation	BS4360 Gr50D
Type	Wrought Metal
Form	Plate
Thickness	25 mm
Composition Type	Yes
Composition Position	1/4T
Lot ID	*
Reference	SHI-01
Composition	
C	0.12 %
Mn	1.38 %
P	0.011 %
S	0.001 %
Si	0.38 %
Cr	0.02 %
Ni	0.15 %
Mo	0.01 %
V	0.006 %
Cu	0.18 %
Cb	0.024 %
Ti	0.015 %
B	<0.0001 %
Al	0.029 %
N	0.0057 %
Other Components	*
Fabrication History	
Heat Treatment	*
Producer	Sumitomo
Year Produced	*
Addl Info	None
Source	Sumitomo
Melting Practice	*
Ingot Position	*
Killing Process	*
Process Temperature	*
Process Time	*
Rolling Conditions	*
Final Processing	N,A
Final Temperature	*
Final Time	*
Cold Work Strain	*
Aging Temperature	600 degC
Aging Time	1 hr
Location	*
Property Measurements	
Test Type	Tensile
Position	*
Specimen Type	Flat
Specimen Thickness	10 mm
Gage Length	200 mm
Loading Rate	*
Tensile Strength Offset	*
Tensile Yield Strength	*
Elongation	*
Reduction in Area	*
Tensile Modulus	*
Standard Method	*
Standard Year	*

Orient	Test Temp degC	UTS N/mm2	TYP kgf/mm2	Uniform El %
L	20	501	371	35.3
L	20	503	370	34.0
T	20	498	368	33.6
T	20	503	374	33.7

* - not reported

Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.2

Description	
Material Code 010.001.010A	Material Name BS4360 Gr50D
UNS *	Other Designation BS4360 Gr50D
Type Wrought Metal	Form Plate
Thickness 25 mm	Composition Type Yes
Composition Position 1/4T	Lot ID *
Reference SHI-01	
Composition	See Page 13800.1
Fabrication History	
Heat Treatment *	Producer Sumitomo
Year Produced *	Addl Info None
Source Sumitomo	Melting Practice *
Ingot Position *	Killing Process *
Process Temperature *	Process Time *
Rolling Conditions *	Final Processing N
Final Temperature *	Final Time *
Cold Work Strain *	Aging Temperature *
Aging Time *	Location *
Property Measurements	
Test Type Tensile	Position *
Specimen Type Flat	Specimen Thickness 10 mm
Gage Length 200 mm	Loading Rate *
Tensile Strength Offset *	Tensile Yield Strength *
Elongation *	Reduction in Area *
Tensile Modulus *	Standard Method *
Standard Year *	

Orient	Test Temp degC	UTS N/mm2	TYP kgf/mm2	Uniform El %
L	20	514	378	33.4
L	20	514	381	35.1
T	20	508	383	31.7
T	20	511	382	31.9

* - not reported



Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.3

Description	
Material Code	010.001.010S
Material Name	BS4360 Gr50D
UNS	*
Other Designation	BS4360 Gr50D
Type	Wrought Metal
Form	Plate
Thickness	25 mm
Composition Type	Yes
Composition Position	1/4T
Lot ID	*
Reference	SHI-01

Composition See Page 13800.1

Fabrication History	
Heat Treatment	*
Producer	Sumitomo
Year Produced	*
Addl Info	None
Source	Sumitomo
Melting Practice	*
Ingot Position	*
Killing Process	*
Process Temperature	*
Process Time	*
Rolling Conditions	*
Final Processing	N,A
Final Temperature	*
Final Time	*
Cold Work Strain	*
Aging Temperature	600 degC
Aging Time	1 hr
Location	*

Property Measurements	
Test Type	Charpy V Impact
Specimen Type	*
Lateral Expansion	*
Shear Fracture	*
Did Specimen Fracture?	*
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Position	Orien	Test Temp degC	CVN Energy Joules
1/2T	L-T ◯	-60	189
1/4T	L-T ◯	-60	216
1/2T	L-T ◯	-40	225
1/4T	L-T ◯	-40	272
1/2T	L-T ◯	-20	242
1/4T	L-T ◯	-20	294
1/2T	T-L ▲	-60	144
1/4T	T-L ▲	-60	215
1/2T	T-L ▲	-40	200
1/4T	T-L ▲	-40	251
1/2T	T-L ▲	-20	234
1/4T	T-L ▲	-20	274

* - not reported

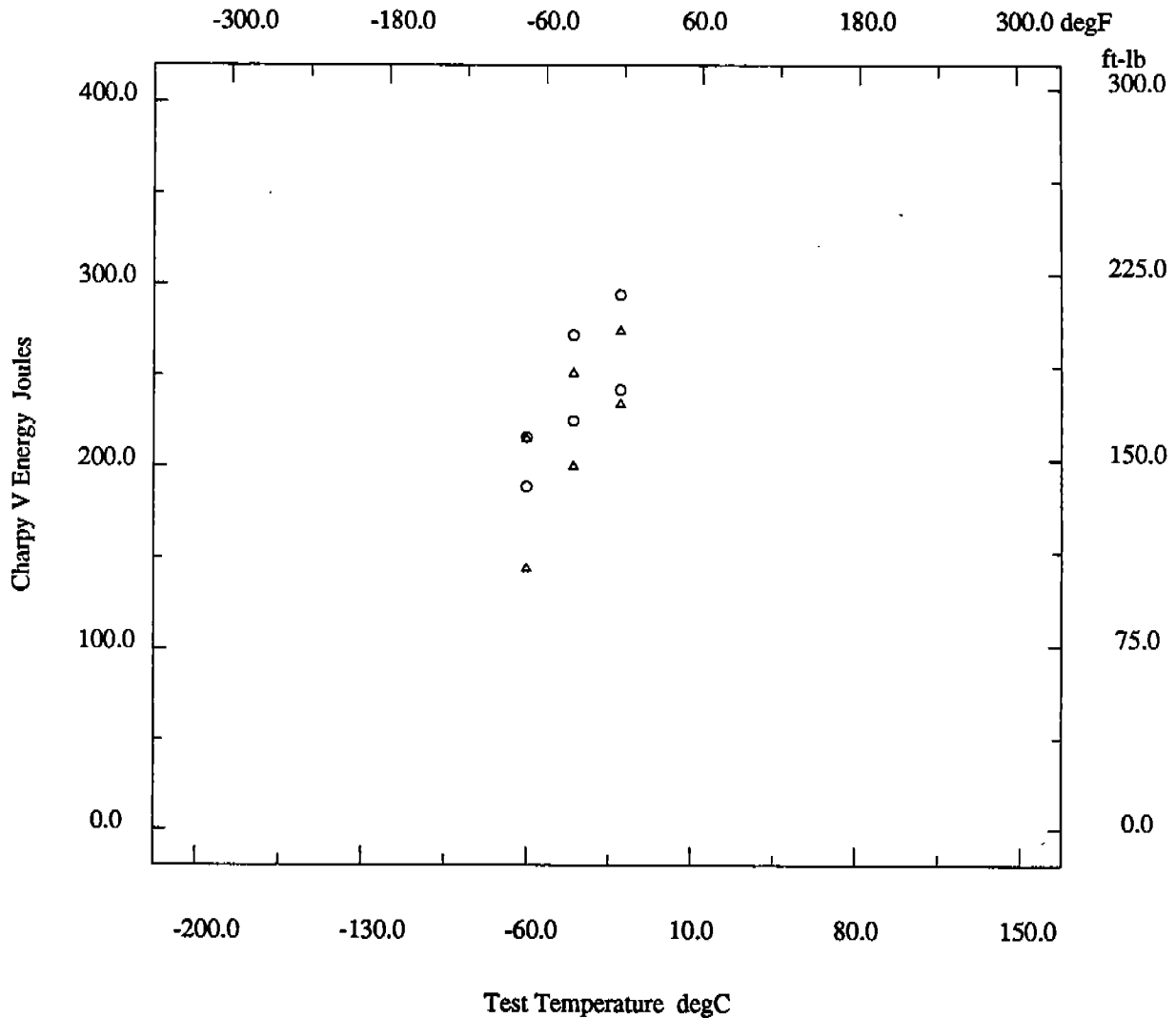


Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.4

Description			
Material Code	010.001.010S	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Wrought Metal	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		



* - not reported

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Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.5

Description	
Material Code	010.001.010A
Material Name	BS4360 Gr50D
UNS	*
Other Designation	BS4360 Gr50D
Type	Wrought Metal
Form	Plate
Thickness	25 mm
Composition Type	Yes
Composition Position	1/4T
Lot ID	*
Reference	SHI-01

Composition	See Page 13800.1
--------------------	------------------

Fabrication History	
Heat Treatment	*
Producer	Sumitomo
Year Produced	*
Addl Info	None
Source	Sumitomo
Melting Practice	*
Ingot Position	*
Killing Process	*
Process Temperature	*
Process Time	*
Rolling Conditions	*
Final Processing	N
Final Temperature	*
Final Time	*
Cold Work Strain	*
Aging Temperature	*
Aging Time	*
Location	*

Property Measurements	
Test Type	Charpy V Impact
Specimen Type	*
Lateral Expansion	*
Shear Fracture	*
Did Specimen Fracture?	*
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Position	Orien	Test Temp degC	CVN Energy Joules
1/2T	L-T ○	-60	128
1/4T	L-T ○	-60	223
1/2T	L-T ○	-40	266
1/4T	L-T ○	-40	244
1/2T	L-T ○	-20	277
1/4T	L-T ○	-20	251
1/2T	T-L ▲	-60	115
1/4T	T-L ▲	-60	211
1/2T	T-L ▲	-40	220
1/4T	T-L ▲	-40	245
1/2T	T-L ▲	-20	273
1/4T	T-L ▲	-20	272

* - not reported

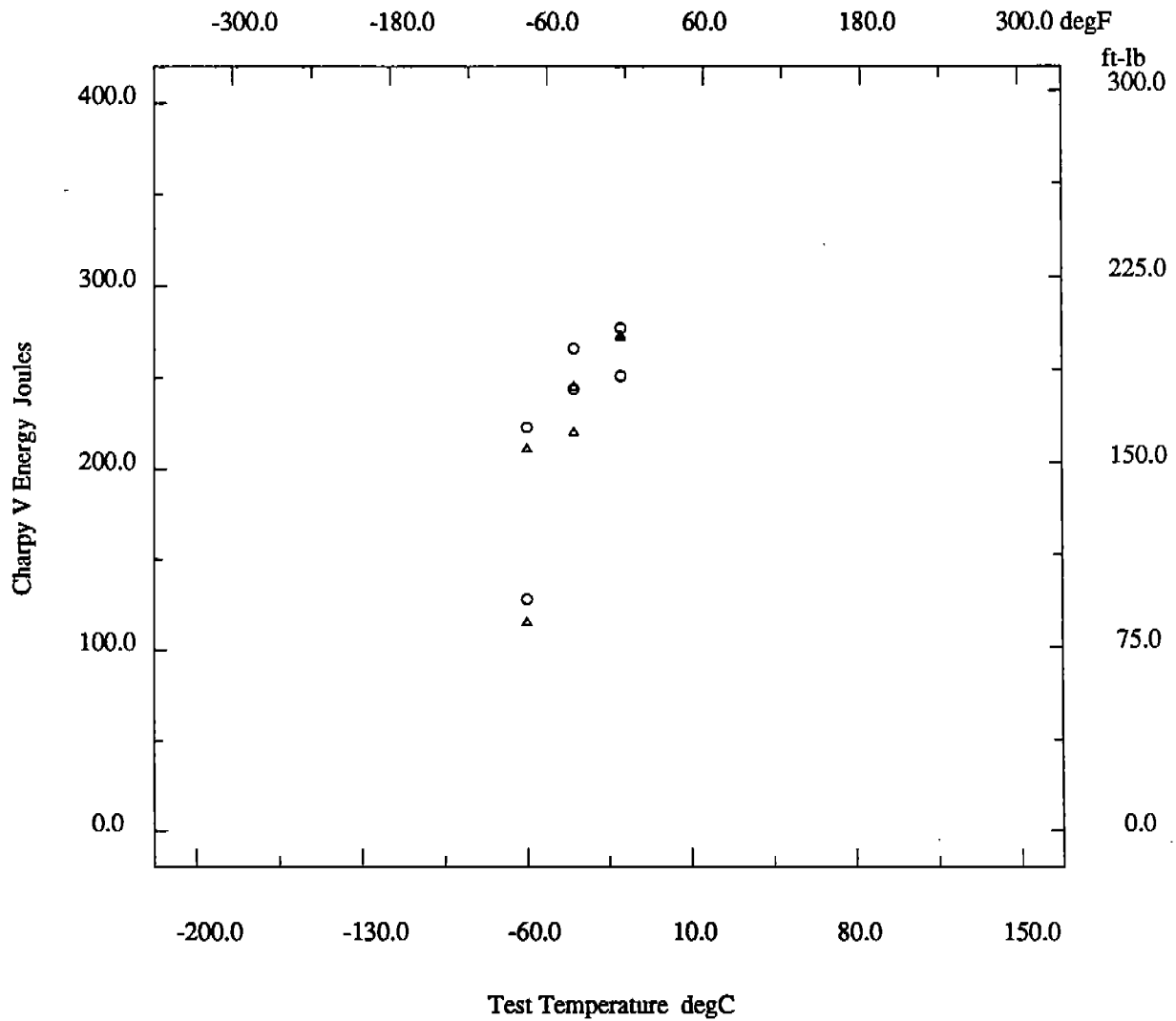
(211)

Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.6

Description	
Material Code	010.001.010A
UNS	*
Type	Wrought Metal
Thickness	25 mm
Composition Position	1/4T
Reference	SHI-01
Material Name	BS4360 Gr50D
Other Designation	BS4360 Gr50D
Form	Plate
Composition Type	Yes
Lot ID	*



* - not reported



Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.7

Description			
Material Code	010.001.010A	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Wrought Metal	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		

Composition See Page 13800.1

Fabrication History See Page 13800.5

Property Measurements			
Test Type	Nil Ductility Transition	Position	0/4T
Specimen Type	P-1	Filler Alloy	*
Passes	*	Orientation	*
Standard Method	E 208	Standard Year	*

Test Temp degC	Break?	NDTT
-65	Yes	No
-65	Yes	No
-65	Yes	No
-60	No	Yes
-60	Yes	Yes
-60	Yes	Yes
-55	No	No
-55	No	No
-55	No	No

* - not reported

Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.8

Description			
Material Code	010.001.09AFA	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		

Composition See Page 13800.1

Fabrication History See Page 13800.5

Weld			
Weld Code	010.001.09AFA	Weld Type	SMA
Base Metal Thickness	25 mm	Welding Position	Downhand
Preheat Temperature	100 degC	Metal Gap	3 mm
Interpass Temperature	250 degC	Passes	*
Filler Specification	*	Filler Name	L-50N
Filler Carbon Content	*	Filler Metal Size	3.2 mm
Shielding Gas	*	Voltage	24 volts
Amperage	100-140 amps	Polarity	*
Travel Speed	15-20 cm/min	Heat Input/Pass	12.5 KJ/cm
Joint Preparation	1/2 V-Groove	Number of Sides	2
Location wrt Weld	11mm in HAZ	Location wrt Surface	Final surface
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		

Property Measurements			
Test Type	Charpy V Impact	Position	1/2T
Specimen Type	Full	Lateral Expansion	*
Shear Fracture	*	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degC	CVN Energy Joules
T-L ◦	-40	120
T-L ◦	-40	127
T-L ◦	-40	169
T-L ◦	-20	162
T-L ◦	-20	166
T-L ◦	-20	171

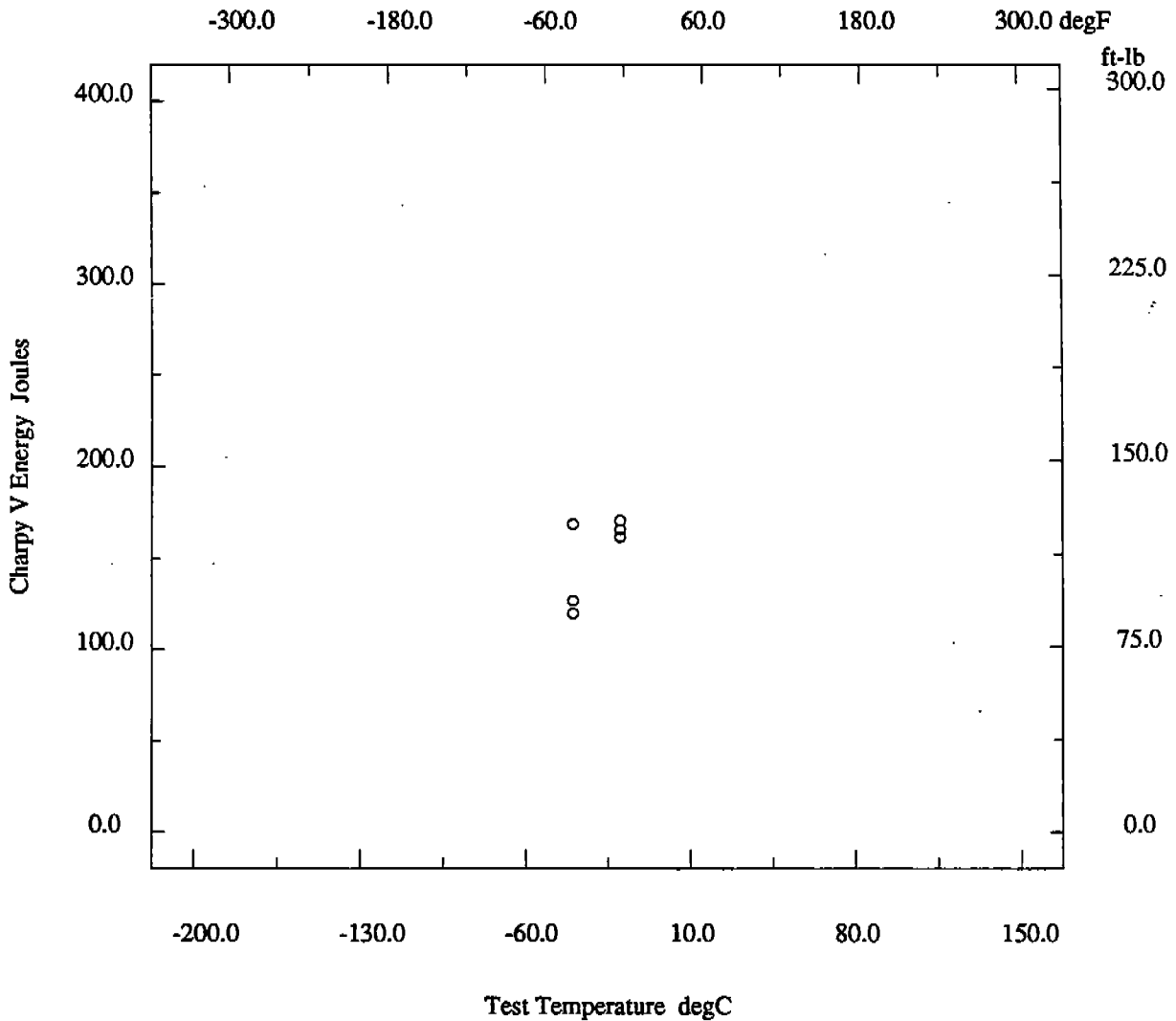
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Marine Structural Toughness Data Bank

Material BS4360 Gr50D

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Description			
Material Code	010.001.09AFA	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		



* - not reported

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Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.10

Description			
Material Code	010.001.02AFA	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		
Composition		See Page 13800.1	
Fabrication History		See Page 13800.5	
Weld			
Weld Code	010.001.02AFA	Weld Type	SMA
Base Metal Thickness	25 mm	Welding Position	Downhand
Preheat Temperature	100 degC	Metal Gap	3 mm
Interpass Temperature	250 degC	Passes	*
Filler Specification	*	Filler Name	L-50N
Filler Carbon Content	*	Filler Metal Size	3.2 mm
Shielding Gas	*	Voltage	24 volts
Amperage	100-140 amps	Polarity	*
Travel Speed	15-20 cm/min	Heat Input/Pass	12.5 KJ/cm
Joint Preparation	1/2 V-Groove	Number of Sides	2
Location wrt Weld	Fusion line	Location wrt Surface	Final surface
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		
Property Measurements			
Test Type	Charpy V Impact	Position	1/2T
Specimen Type	Full	Lateral Expansion	*
Shear Fracture	*	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degC	CVN Energy Joules
T-L ◦	-40	180
T-L ◦	-40	80
T-L ◦	-40	93
T-L ◦	-20	194
T-L ◦	-20	290
T-L ◦	-20	290

* - not reported

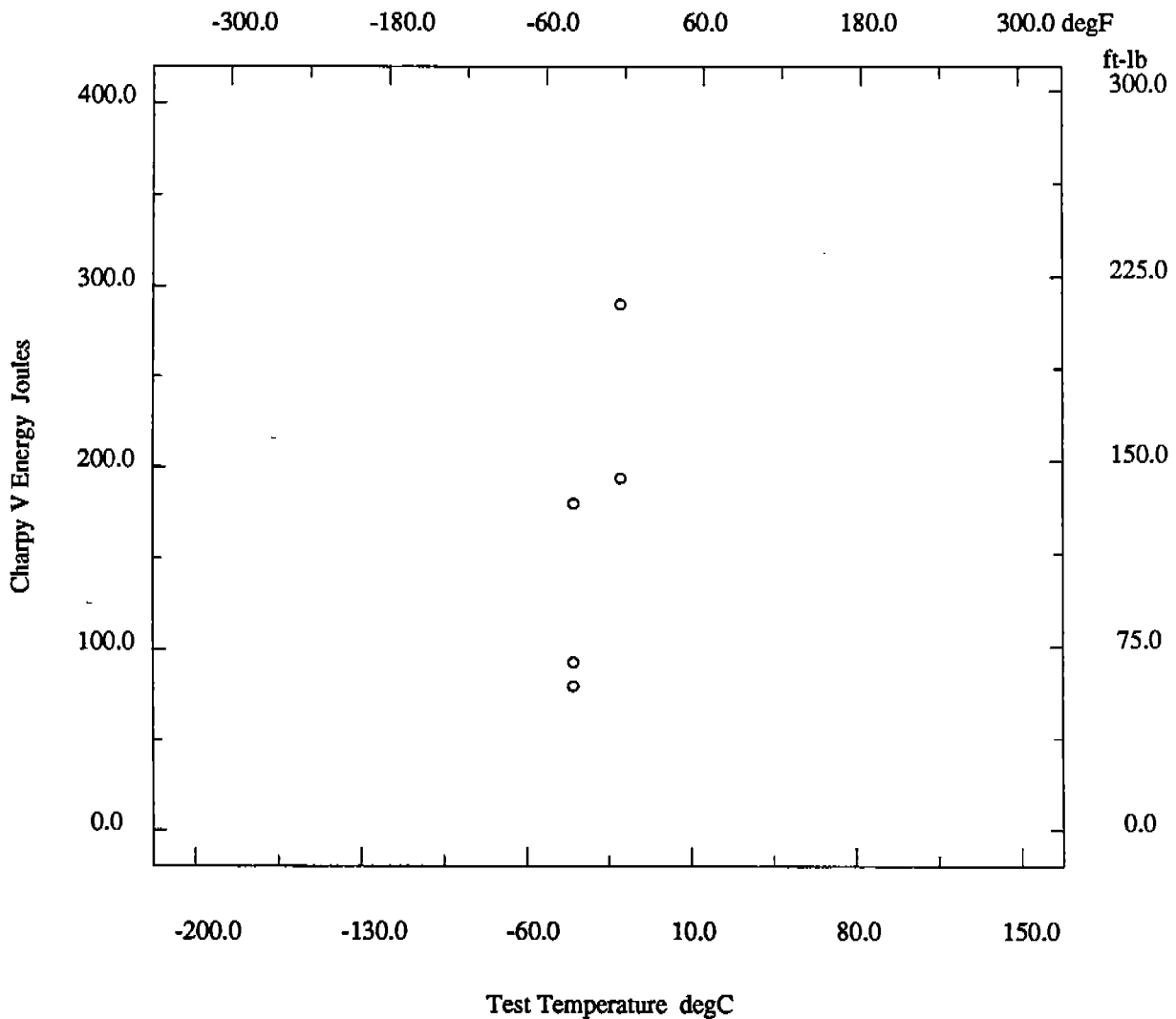


Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.11

Description				
Material Code	010.001.02AFA	Material Name	BS4360 Gr50D	
UNS	*	Other Designation	BS4360 Gr50D	
Type	Welded Joint	Form	Plate	
Thickness	25 mm	Composition Type	Yes	
Composition Position	1/4T	Lot ID	*	
Reference	SHI-01			



* - not reported

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Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.12

Description			
Material Code	010.001.03AFA	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		

Composition See Page 13800.1

Fabrication History See Page 13800.5

Weld			
Weld Code	010.001.03AFA	Weld Type	SMA
Base Metal Thickness	25 mm	Welding Position	Downhand
Preheat Temperature	100 degC	Metal Gap	3 mm
Interpass Temperature	250 degC	Passes	*
Filler Specification	*	Filler Name	L-50N
Filler Carbon Content	*	Filler Metal Size	3.2 mm
Shielding Gas	*	Voltage	24 volts
Amperage	100-140 amps	Polarity	*
Travel Speed	15-20 cm/min	Heat Input/Pass	12.5 KJ/cm
Joint Preparation	1/2 V-Groove	Number of Sides	2
Location wrt Weld	1mm in HAZ	Location wrt Surface	Final surface
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		

Property Measurements			
Test Type	Charpy V Impact	Position	1/2T
Specimen Type	Full	Lateral Expansion	*
Shear Fracture	*	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degC	CVN Energy Joules
T-L ◦	-40	238
T-L ◦	-40	240
T-L ◦	-40	291
T-L ◦	-20	279
T-L ◦	-20	289
T-L ◦	-20	292

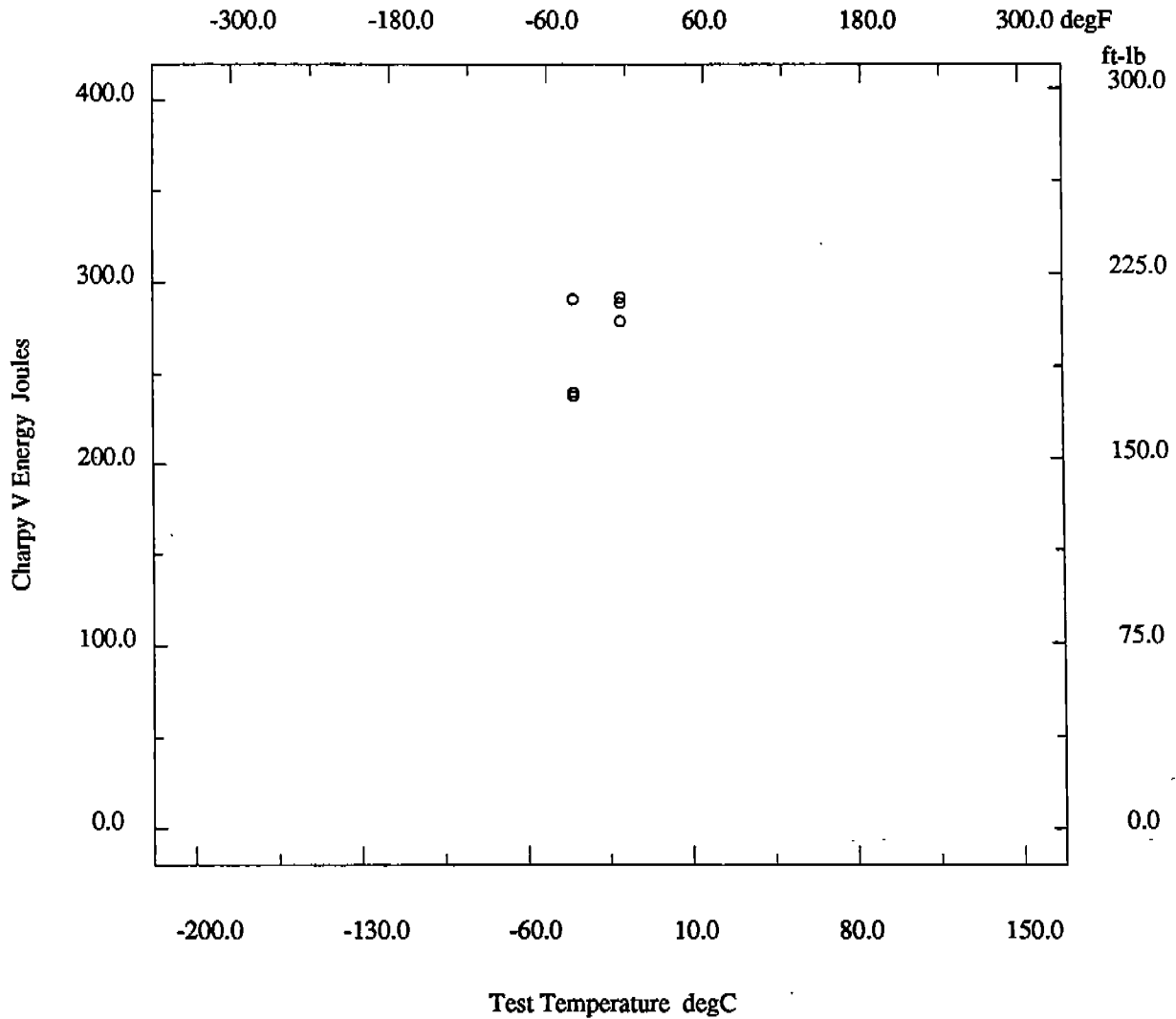
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Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.13

Description	
Material Code	010.001.03AFA
UNS	*
Type	Welded Joint
Thickness	25 mm
Composition Position	1/4T
Reference	SHI-01
Material Name	BS4360 Gr50D
Other Designation	BS4360 Gr50D
Form	Plate
Composition Type	Yes
Lot ID	*



* - not reported

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Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.14

Description			
Material Code	010.001.04AFA	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		
Composition		See Page 13800.1	
Fabrication History		See Page 13800.5	
Weld			
Weld Code	010.001.04AFA	Weld Type	SMA
Base Metal Thickness	25 mm	Welding Position	Downhand
Preheat Temperature	100 degC	Metal Gap	3 mm
Interpass Temperature	250 degC	Passes	*
Filler Specification	*	Filler Name	L-50N
Filler Carbon Content	*	Filler Metal Size	3.2 mm
Shielding Gas	*	Voltage	24 volts
Amperage	100-140 amps	Polarity	*
Travel Speed	15-20 cm/min	Heat Input/Pass	12.5 KJ/cm
Joint Preparation	1/2 V-Groove	Number of Sides	2
Location wrt Weld	3mm in HAZ	Location wrt Surface	Final surface
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		
Property Measurements			
Test Type	Charpy V Impact	Position	1/2T
Specimen Type	Full	Lateral Expansion	*
Shear Fracture	*	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degC	CVN Energy Joules
T-L ◦	-40	148
T-L ◦	-40	239
T-L ◦	-40	292
T-L ◦	-20	259
T-L ◦	-20	289
T-L ◦	-20	292

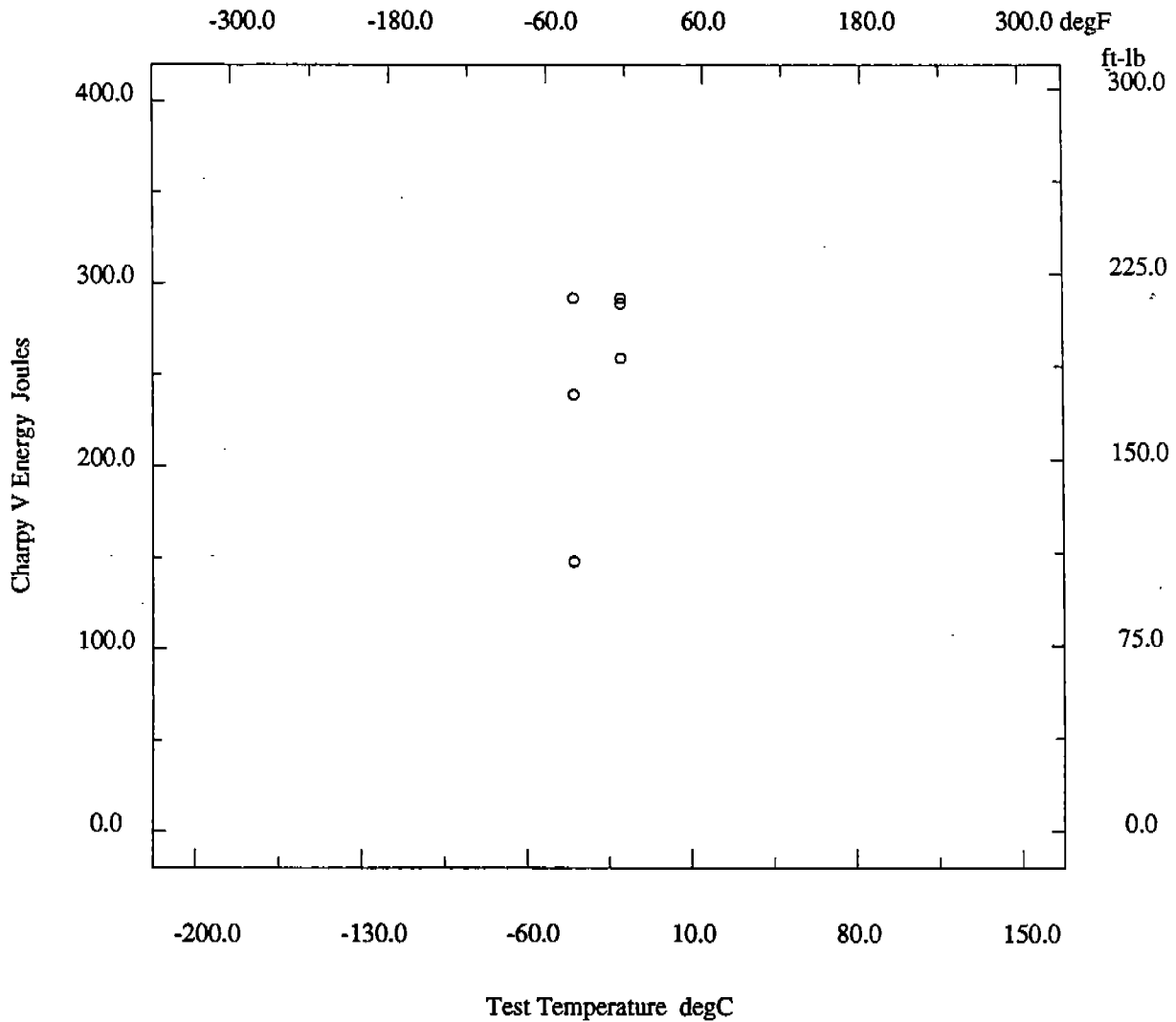
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Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.15

Description	
Material Code	010.001.04AFA
UNS	*
Type	Welded Joint
Thickness	25 mm
Composition Position	1/4T
Reference	SHI-01
Material Name	BS4360 Gr50D
Other Designation	BS4360 Gr50D
Form	Plate
Composition Type	Yes
Lot ID	*



* - not reported

Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.16

Description			
Material Code	010.001.05AFA	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		

Composition See Page 13800.1

Fabrication History See Page 13800.5

Weld			
Weld Code	010.001.05AFA	Weld Type	SMA
Base Metal Thickness	25 mm	Welding Position	Downhand
Preheat Temperature	100 degC	Metal Gap	3 mm
Interpass Temperature	250 degC	Passes	*
Filler Specification	*	Filler Name	L-50N
Filler Carbon Content	*	Filler Metal Size	3.2 mm
Shielding Gas	*	Voltage	24 volts
Amperage	100-140 amps	Polarity	*
Travel Speed	15-20 cm/min	Heat Input/Pass	12.5 KJ/cm
Joint Preparation	1/2 V-Groove	Number of Sides	2
Location wrt Weld	5mm in HAZ	Location wrt Surface	Final surface
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		

Property Measurements			
Test Type	Charpy V Impact	Position	1/2T
Specimen Type	Full	Lateral Expansion	*
Shear Fracture	*	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degC	CVN Energy Joules
T-L ◦	-40	229
T-L ◦	-40	258
T-L ◦	-40	272
T-L ◦	-20	272
T-L ◦	-20	292
T-L ◦	-20	292

* - not reported

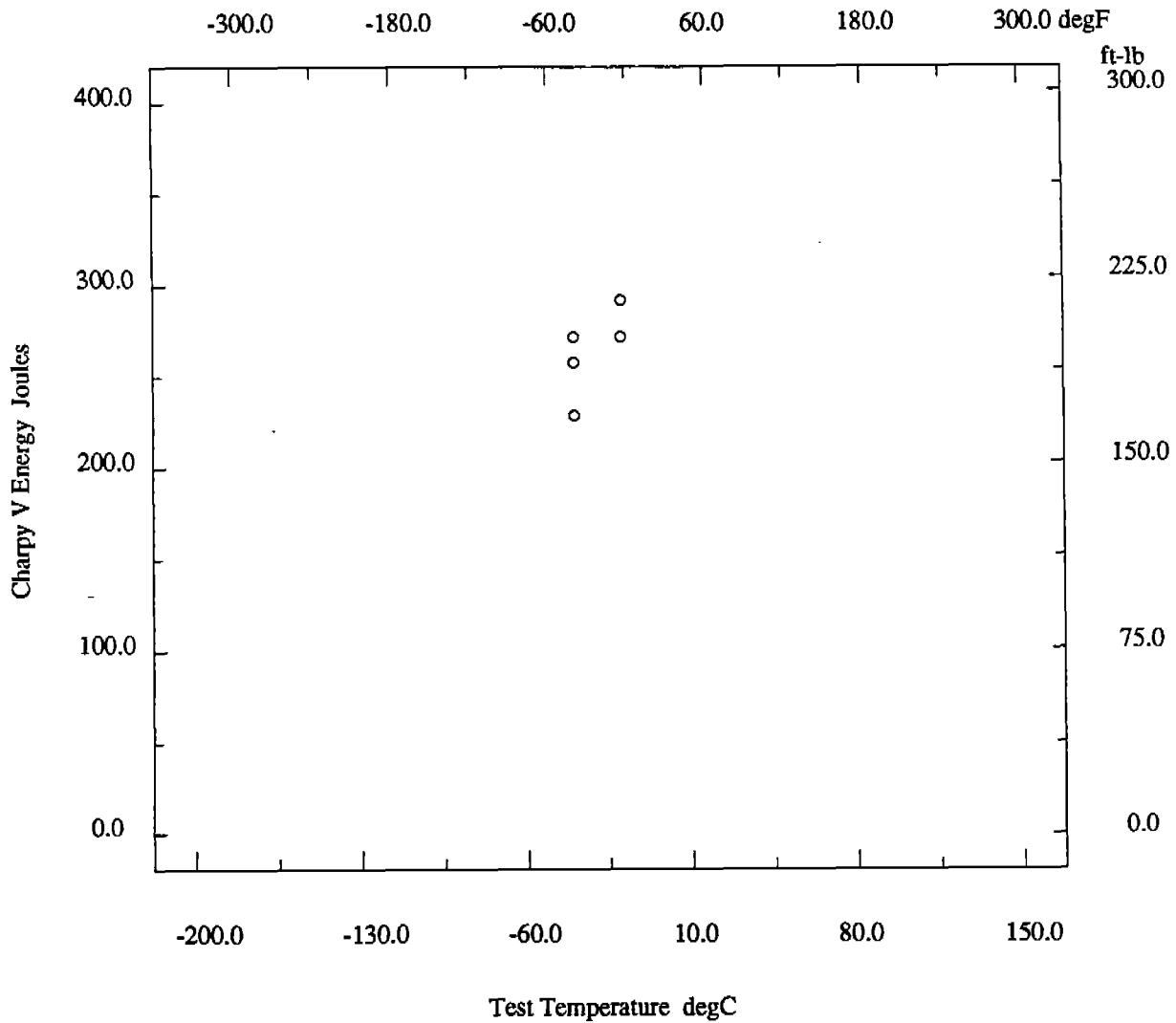


Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.17

Description			
Material Code	010.001.05AFA	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		



* - not reported

Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.18

Description			
Material Code	010.001.11AFA	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		

Composition See Page 13800.1

Fabrication History See Page 13800.5

Weld			
Weld Code	010.001.11AFA	Weld Type	SMA
Base Metal Thickness	25 mm	Welding Position	Downhand
Preheat Temperature	100 degC	Metal Gap	3 mm
Interpass Temperature	250 degC	Passes	*
Filler Specification	*	Filler Name	L-50N
Filler Carbon Content	*	Filler Metal Size	3.2 mm
Shielding Gas	*	Voltage	24 volts
Amperage	100-140 amps	Polarity	*
Travel Speed	15-20 cm/min	Heat Input/Pass	12.5 KJ/cm
Joint Preparation	1/2 V-Groove	Number of Sides	2
Location wrt Weld	50% weld, 50% HAZ	Location wrt Surface	Final surface
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		

Property Measurements			
Test Type	Charpy V Impact	Position	1/2T
Specimen Type	Full	Lateral Expansion	*
Shear Fracture	*	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degC	CVN Energy Joules
T-L ◦	-40	121
T-L ◦	-40	145
T-L ◦	-40	98
T-L ◦	-20	205
T-L ◦	-20	207
T-L ◦	-20	283

* - not reported

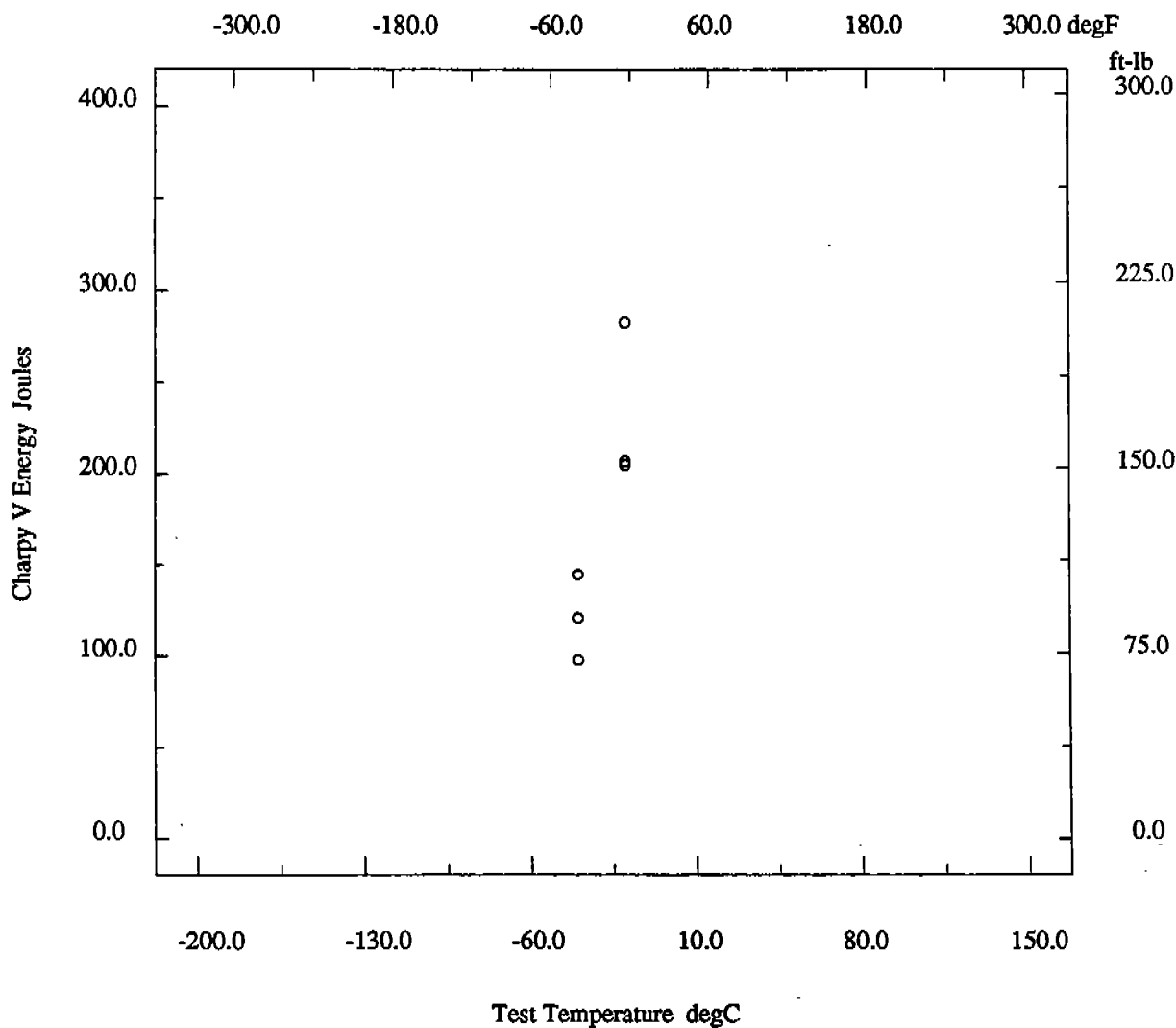


Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.19

Description			
Material Code	010.001.11AFA	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		



* - not reported

Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.20

Description			
Material Code	010.001.09ABA	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		

Composition See Page 13800.1

Fabrication History See Page 13800.5

Weld			
Weld Code	010.001.09ABA	Weld Type	SMA
Base Metal Thickness	25 mm	Welding Position	Downhand
Preheat Temperature	100 degC	Metal Gap	3 mm
Interpass Temperature	250 degC	Passes	*
Filler Specification	*	Filler Name	L-50N
Filler Carbon Content	*	Filler Metal Size	3.2 mm
Shielding Gas	*	Voltage	24 volts
Amperage	100-140 amps	Polarity	*
Travel Speed	15-20 cm/min	Heat Input/Pass	12.5 KJ/cm
Joint Preparation	1/2 V-Groove	Number of Sides	2
Location wrt Weld	11mm in HAZ	Location wrt Surface	Back surface not root
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		

Property Measurements			
Test Type	Charpy V Impact	Position	3/4T
Specimen Type	Full	Lateral Expansion	*
Shear Fracture	*	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degC	CVN Energy Joules
T-L ◦	-40	101
T-L ◦	-40	58
T-L ◦	-40	80
T-L ◦	-20	129
T-L ◦	-20	151
T-L ◦	-20	179

* - not reported

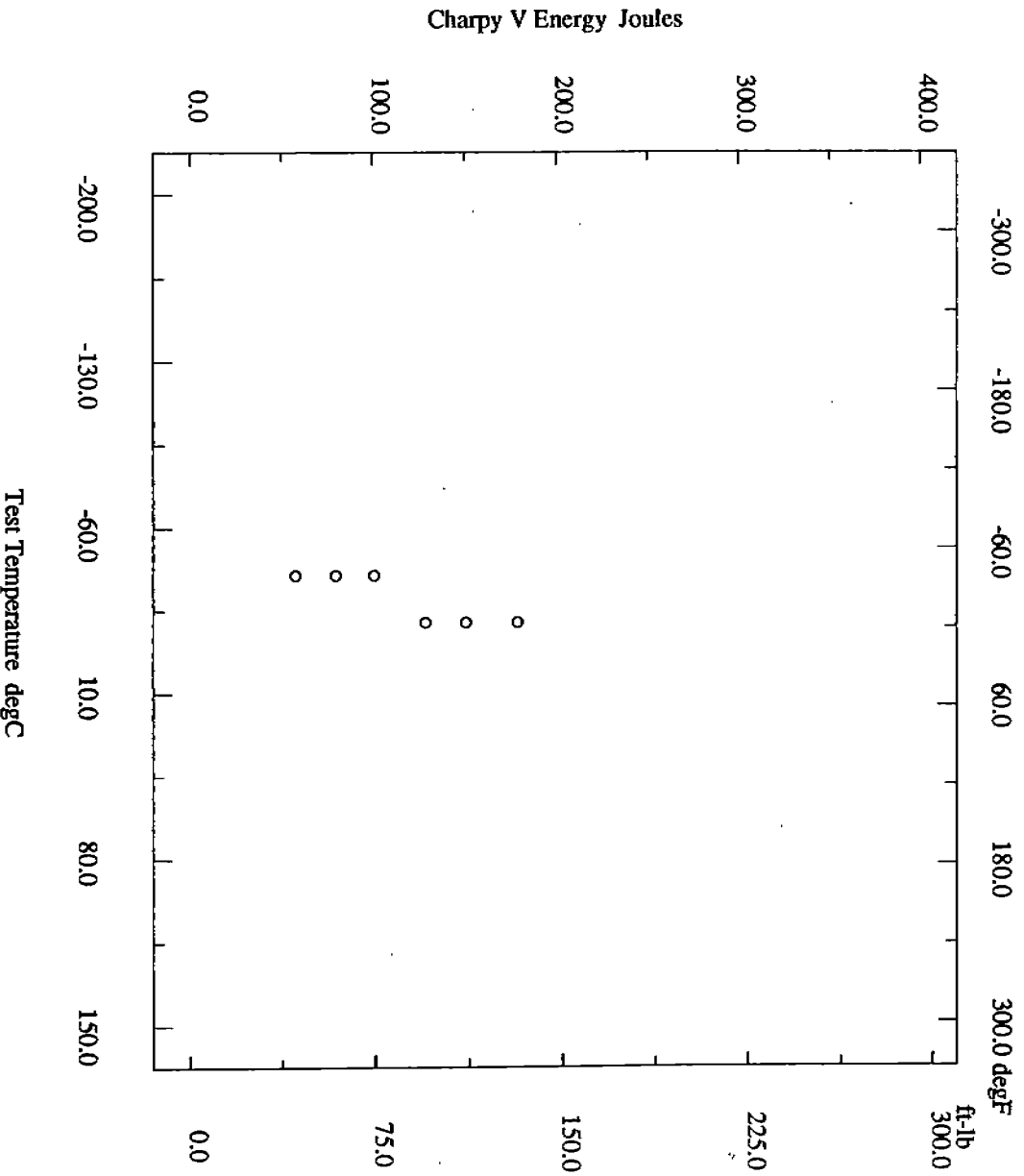


Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.21

Description	
Material Code	010.001.09ABA
Material Name	BS4360 Gr50D
UNSN	*
Other Designation	BS4360 Gr50D
Type	Welded Joint
Form	Plate
Thickness	25 mm
Composition Type	Yes
Composition Position	1/4T
Lot ID	*
Reference	SHI-01



* - not reported

Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.22

Description	
Material Code	010.001.02ABA
Material Name	BS4360 Gr50D
UNS	*
Other Designation	BS4360 Gr50D
Type	Welded Joint
Form	Plate
Thickness	25 mm
Composition Type	Yes
Composition Position	1/4T
Lot ID	*
Reference	SHI-01
Composition See Page 13800.1	
Fabrication History See Page 13800.5	
Weld	
Weld Code	010.001.02ABA
Weld Type	SMA
Base Metal Thickness	25 mm
Welding Position	Downhand
Preheat Temperature	100 degC
Metal Gap	3 mm
Interpass Temperature	250 degC
Passes	*
Filler Specification	*
Filler Name	L-50N
Filler Carbon Content	*
Filler Metal Size	3.2 mm
Shielding Gas	*
Voltage	24 volts
Amperage	100-140 amps
Polarity	*
Travel Speed	15-20 cm/min
Heat Input/Pass	12.5 KJ/cm
Joint Preparation	1/2 V-Groove
Number of Sides	2
Location wrt Weld	Fusion line
Location wrt Surface	Back surface not root
Post-Weld Heat Temp	*
Post-Weld Heat Time	*
Flux Type	*
Flux Name	*
Weld Composition Reported?	No
Property Measurements	
Test Type	Charpy V Impact
Position	3/4T
Specimen Type	Full
Lateral Expansion	*
Shear Fracture	*
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degC	CVN Energy Joules
T-L ◦	-40	115
T-L ◦	-40	52
T-L ◦	-40	71
T-L ◦	-20	131
T-L ◦	-20	172
T-L ◦	-20	210

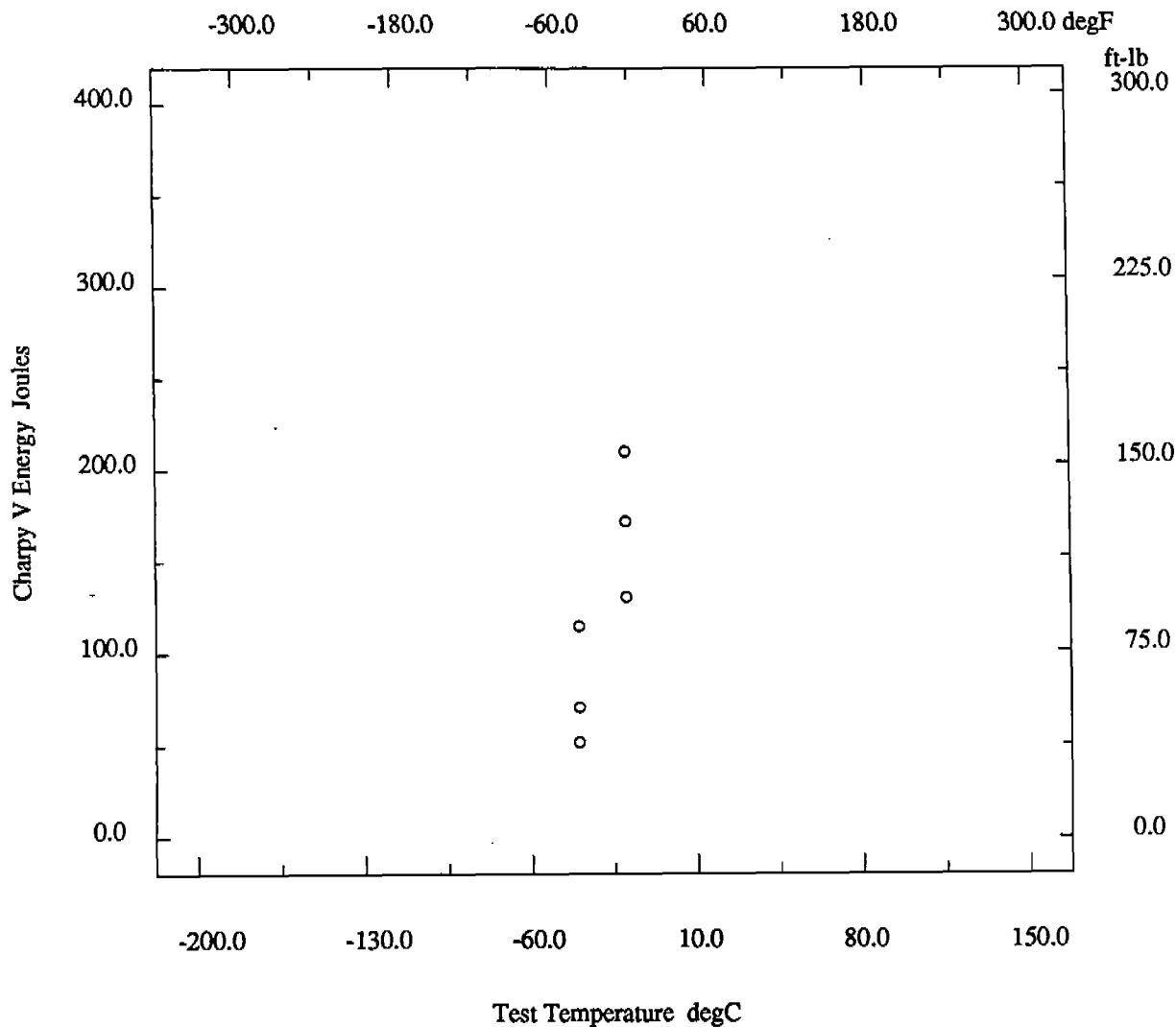
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Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.23

Description			
Material Code	010.001.02ABA	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		



* - not reported

Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.24

Description			
Material Code	010.001.09AFS	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		

Composition See Page 13800.1

Fabrication History See Page 13800.5

Weld			
Weld Code	010.001.09AFS	Weld Type	SMA
Base Metal Thickness	25 mm	Welding Position	Downhand
Preheat Temperature	100 degC	Metal Gap	3 mm
Interpass Temperature	250 degC	Passes	*
Filler Specification	*	Filler Name	L-50N
Filler Carbon Content	*	Filler Metal Size	3.2 mm
Shielding Gas	*	Voltage	24 volts
Amperage	100-140 amps	Polarity	*
Travel Speed	15-20 cm/min	Heat Input/Pass	12.5 KJ/cm
Joint Preparation	1/2 V-Groove	Number of Sides	2
Location wrt Weld	11mm in HAZ	Location wrt Surface	Final surface
Post-Weld Heat Temp	600 degC	Post-Weld Heat Time	1 hr
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		

Property Measurements			
Test Type	Charpy V Impact	Position	1/2T
Specimen Type	Full	Lateral Expansion	*
Shear Fracture	*	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degC	CVN Energy Joules
T-L ◦	-40	152
T-L ◦	-40	159
T-L ◦	-40	166
T-L ◦	-20	157
T-L ◦	-20	204
T-L ◦	-20	216

* - not reported

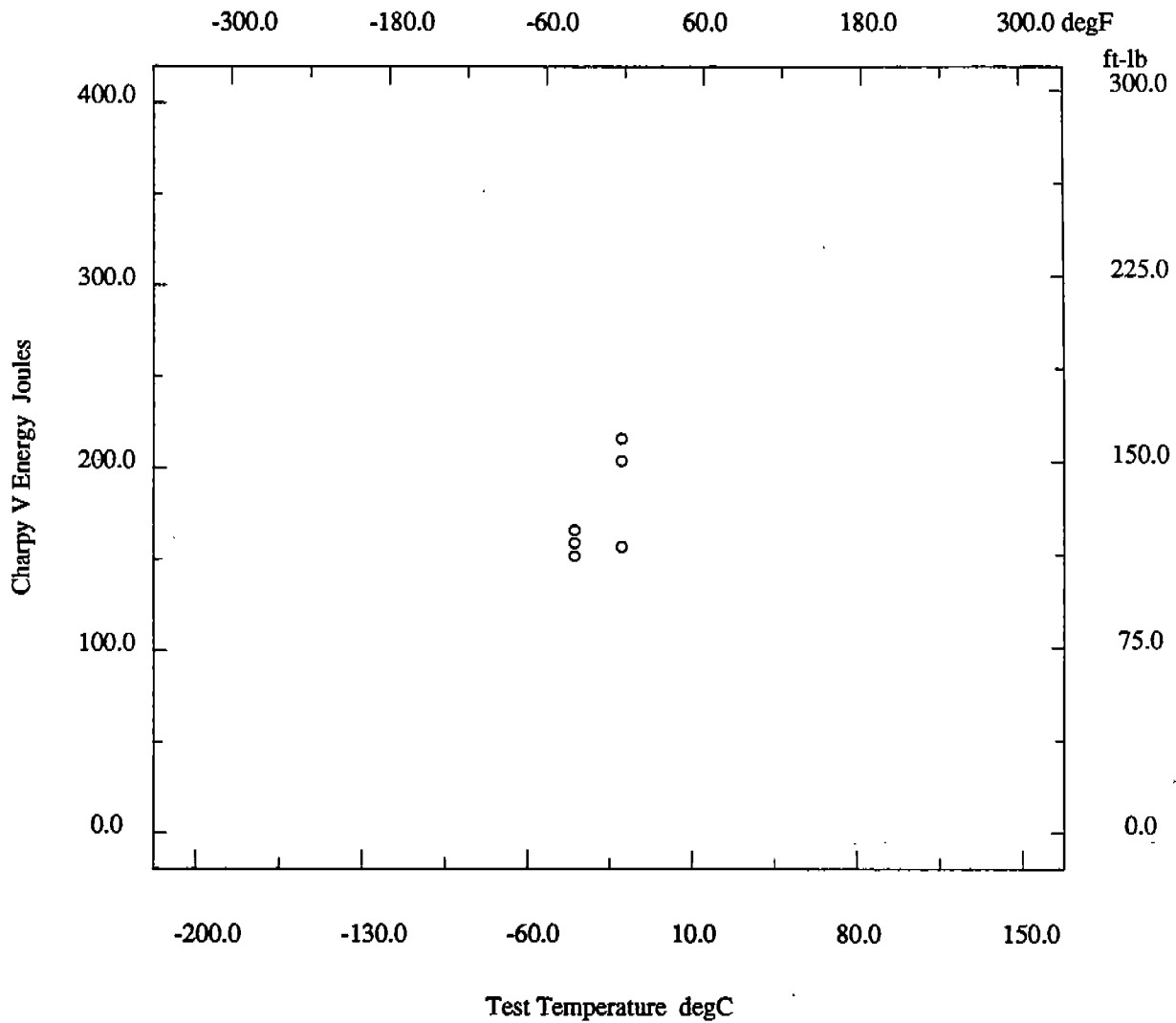


Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.25

Description	
Material Code	010.001.09AFS
UNS	*
Type	Welded Joint
Thickness	25 mm
Composition Position	1/4T
Reference	SHI-01
Material Name	BS4360 Gr50D
Other Designation	BS4360 Gr50D
Form	Plate
Composition Type	Yes
Lot ID	*



* - not reported

Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.26

Description			
Material Code	010.001.02AFS	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		

Composition See Page 13800.1

Fabrication History See Page 13800.5

Weld			
Weld Code	010.001.02AFS	Weld Type	SMA
Base Metal Thickness	25 mm	Welding Position	Downhand
Preheat Temperature	100 degC	Metal Gap	3 mm
Interpass Temperature	250 degC	Passes	*
Filler Specification	*	Filler Name	L-50N
Filler Carbon Content	*	Filler Metal Size	3.2 mm
Shielding Gas	*	Voltage	24 volts
Amperage	100-140 amps	Polarity	*
Travel Speed	15-20 cm/min	Heat Input/Pass	12.5 KJ/cm
Joint Preparation	1/2 V-Groove	Number of Sides	2
Location wrt Weld	Fusion line	Location wrt Surface	Final surface
Post-Weld Heat Temp	600 degC	Post-Weld Heat Time	1 hr
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		

Property Measurements			
Test Type	Charpy V Impact	Position	1/2T
Specimen Type	Full	Lateral Expansion	*
Shear Fracture	*	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degC	CVN Energy Joules
T-L ◦	-40	115
T-L ◦	-40	124
T-L ◦	-40	176
T-L ◦	-20	131
T-L ◦	-20	155
T-L ◦	-20	220

* - not reported

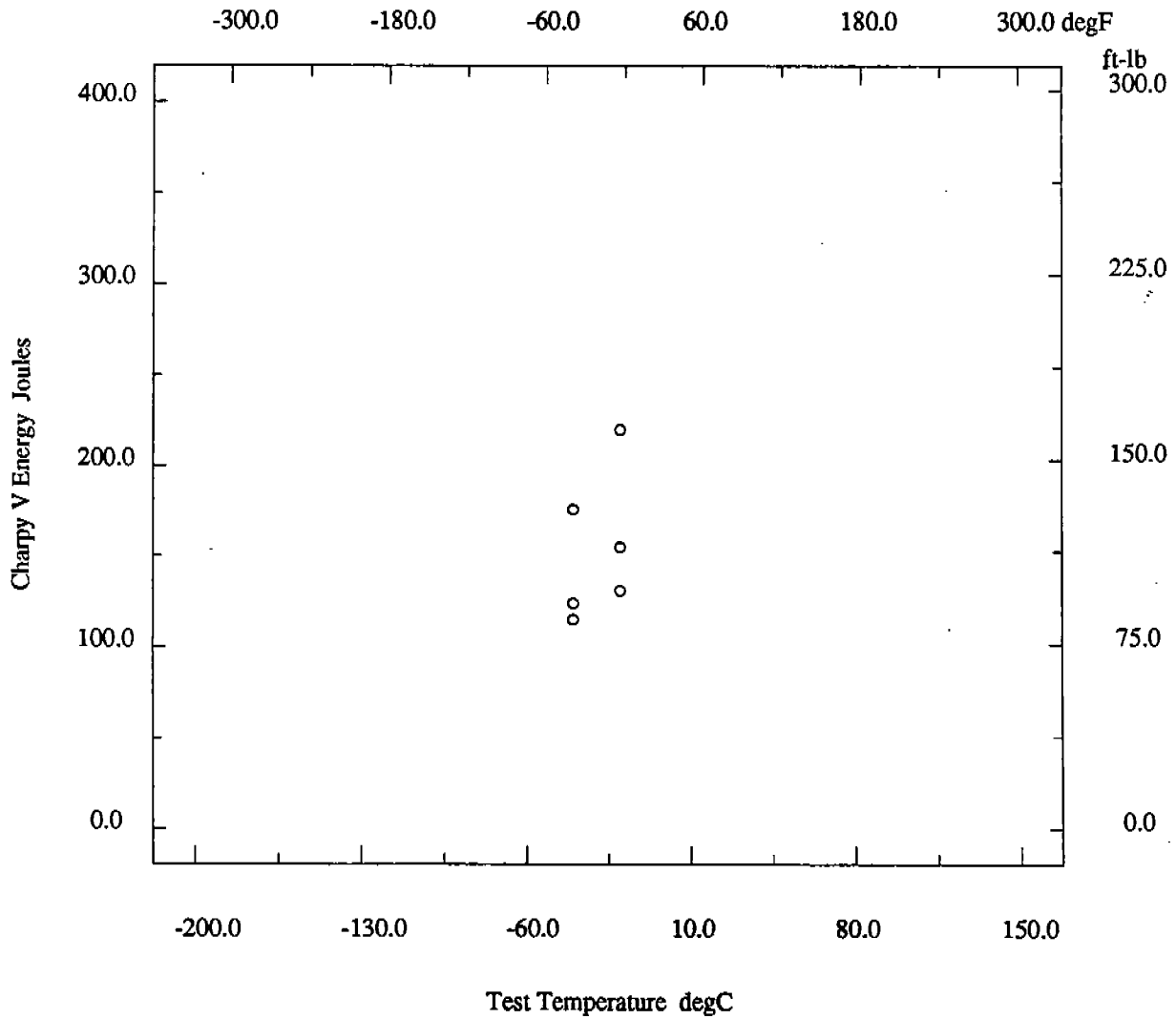
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Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.27

Description	
Material Code	010.001.02AFS
UNS	*
Type	Welded Joint
Thickness	25 mm
Composition Position	1/4T
Reference	SHI-01
Material Name	BS4360 Gr50D
Other Designation	BS4360 Gr50D
Form	Plate
Composition Type	Yes
Lot ID	*



* - not reported



Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.28

Description	
Material Code	010.001.03AFS
Material Name	BS4360 Gr50D
UNS	*
Other Designation	BS4360 Gr50D
Type	Welded Joint
Form	Plate
Thickness	25 mm
Composition Type	Yes
Composition Position	1/4T
Lot ID	*
Reference	SHI-01

Composition See Page 13800.1

Fabrication History See Page 13800.5

Weld	
Weld Code	010.001.03AFS
Weld Type	SMA
Base Metal Thickness	25 mm
Welding Position	Downhand
Preheat Temperature	100 degC
Metal Gap	3 mm
Interpass Temperature	250 degC
Passes	*
Filler Specification	*
Filler Name	L-50N
Filler Carbon Content	*
Filler Metal Size	3.2 mm
Shielding Gas	*
Voltage	24 volts
Amperage	100-140 amps
Polarity	*
Travel Speed	15-20 cm/min
Heat Input/Pass	12.5 KJ/cm
Joint Preparation	1/2 V-Groove
Number of Sides	2
Location wrt Weld	1mm in HAZ
Location wrt Surface	Final surface
Post-Weld Heat Temp	600 degC
Post-Weld Heat Time	1 hr
Flux Type	*
Flux Name	*
Weld Composition Reported?	No

Property Measurements	
Test Type	Charpy V Impact
Position	1/2T
Specimen Type	Full
Lateral Expansion	*
Shear Fracture	*
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degC	CVN Energy Joules
T-L ◦	-40	279
T-L ◦	-40	291
T-L ◦	-40	292
T-L ◦	-20	294
T-L ◦	-20	294
T-L ◦	-20	294

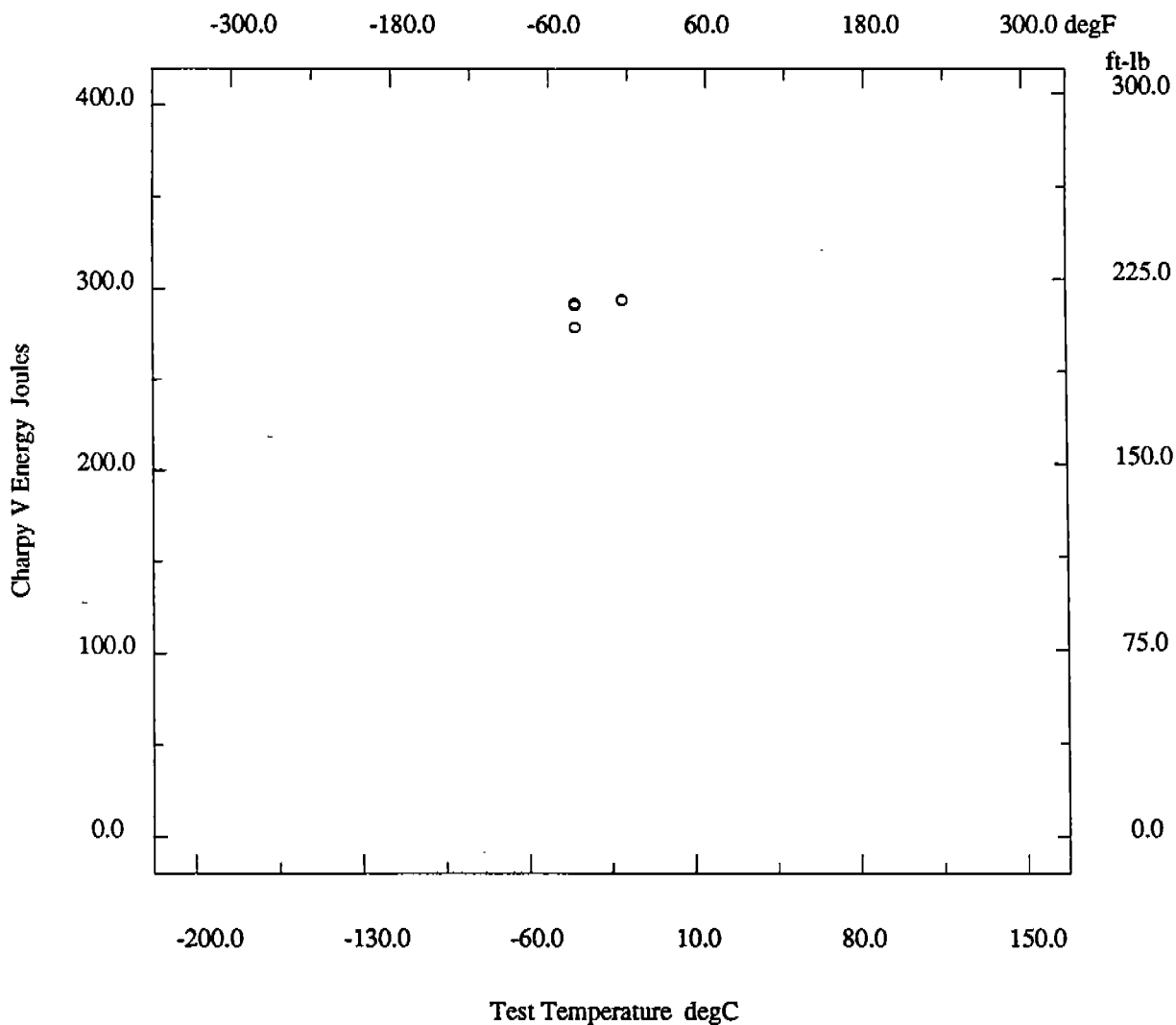
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Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.29

Description	
Material Code	010.001.03AFS
UNS	*
Type	Welded Joint
Thickness	25 mm
Composition Position	1/4T
Reference	SHI-01
Material Name	BS4360 Gr50D
Other Designation	BS4360 Gr50D
Form	Plate
Composition Type	Yes
Lot ID	*



* - not reported

Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.30

Description			
Material Code	010.001.04AFS	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		

Composition See Page 13800.1

Fabrication History See Page 13800.5

Weld			
Weld Code	010.001.04AFS	Weld Type	SMA
Base Metal Thickness	25 mm	Welding Position	Downhand
Preheat Temperature	100 degC	Metal Gap	3 mm
Interpass Temperature	250 degC	Passes	*
Filler Specification	*	Filler Name	L-50N
Filler Carbon Content	*	Filler Metal Size	3.2 mm
Shielding Gas	*	Voltage	24 volts
Amperage	100-140 amps	Polarity	*
Travel Speed	15-20 cm/min	Heat Input/Pass	12.5 KJ/cm
Joint Preparation	1/2 V-Groove	Number of Sides	2
Location wrt Weld	3mm in HAZ	Location wrt Surface	Final surface
Post-Weld Heat Temp	600 degC	Post-Weld Heat Time	1 hr
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		

Property Measurements			
Test Type	Charpy V Impact	Position	1/2T
Specimen Type	Full	Lateral Expansion	*
Shear Fracture	*	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degC	CVN Energy Joules
T-L ◦	-40	233
T-L ◦	-40	249
T-L ◦	-40	240
T-L ◦	-20	279
T-L ◦	-20	294
T-L ◦	-20	294

* - not reported

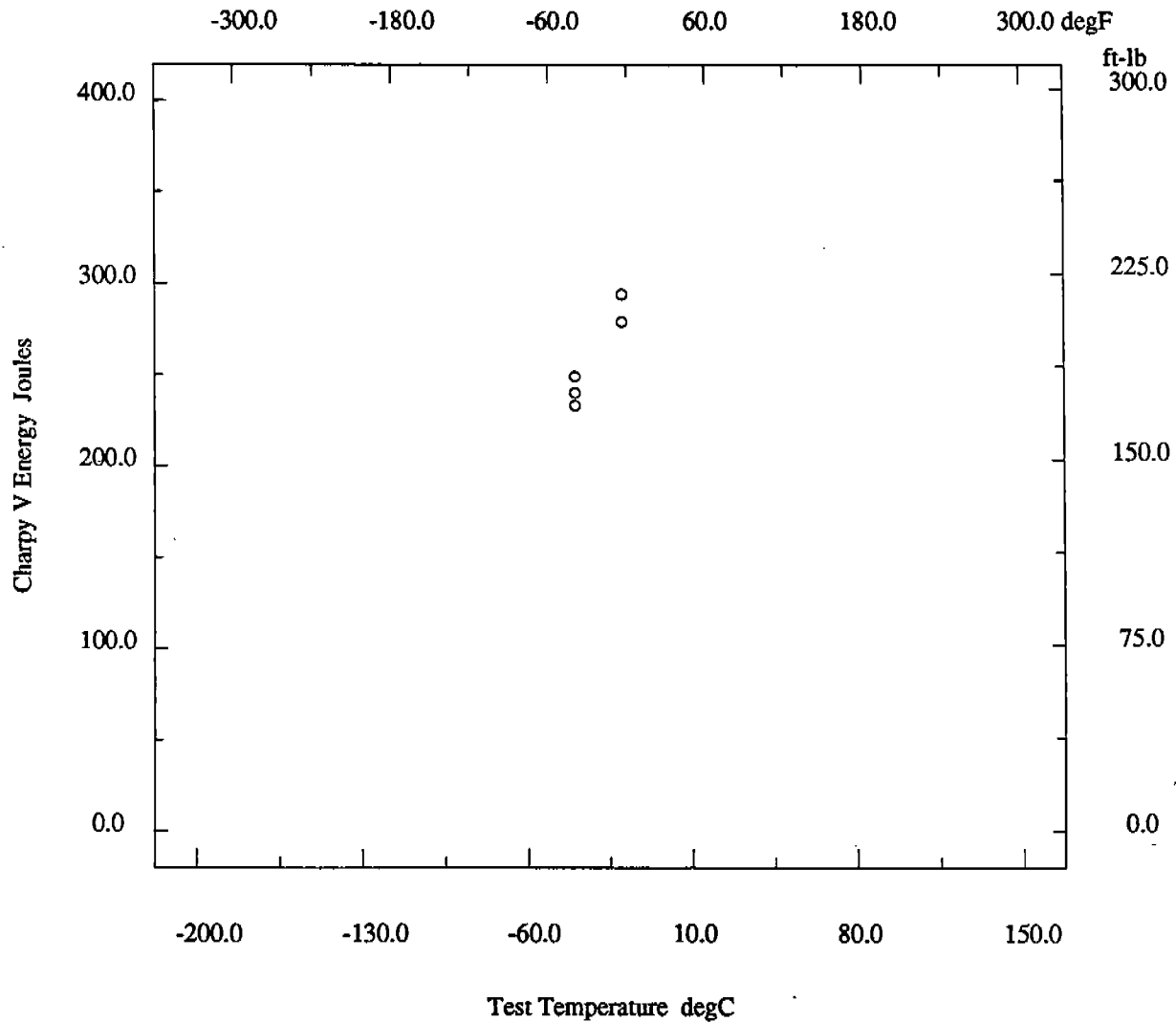


Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.31

Description			
Material Code	010.001.04AFS	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		



* - not reported

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Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.32

Description			
Material Code	010.001.05AFS	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		

Composition See Page 13800.1

Fabrication History See Page 13800.5

Weld			
Weld Code	010.001.05AFS	Weld Type	SMA
Base Metal Thickness	25 mm	Welding Position	Downhand
Preheat Temperature	100 degC	Metal Gap	3 mm
Interpass Temperature	250 degC	Passes	*
Filler Specification	*	Filler Name	L-50N
Filler Carbon Content	*	Filler Metal Size	3.2 mm
Shielding Gas	*	Voltage	24 volts
Amperage	100-140 amps	Polarity	*
Travel Speed	15-20 cm/min	Heat Input/Pass	12.5 KJ/cm
Joint Preparation	1/2 V-Groove	Number of Sides	2
Location wrt Weld	5mm in HAZ	Location wrt Surface	Final surface
Post-Weld Heat Temp	600 degC	Post-Weld Heat Time	1 hr
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		

Property Measurements			
Test Type	Charpy V Impact	Position	1/2T
Specimen Type	Full	Lateral Expansion	*
Shear Fracture	*	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degC	CVN Energy Joules
T-L ◦	-40	246
T-L ◦	-40	253
T-L ◦	-40	256
T-L ◦	-20	218
T-L ◦	-20	219
T-L ◦	-20	257

* - not reported

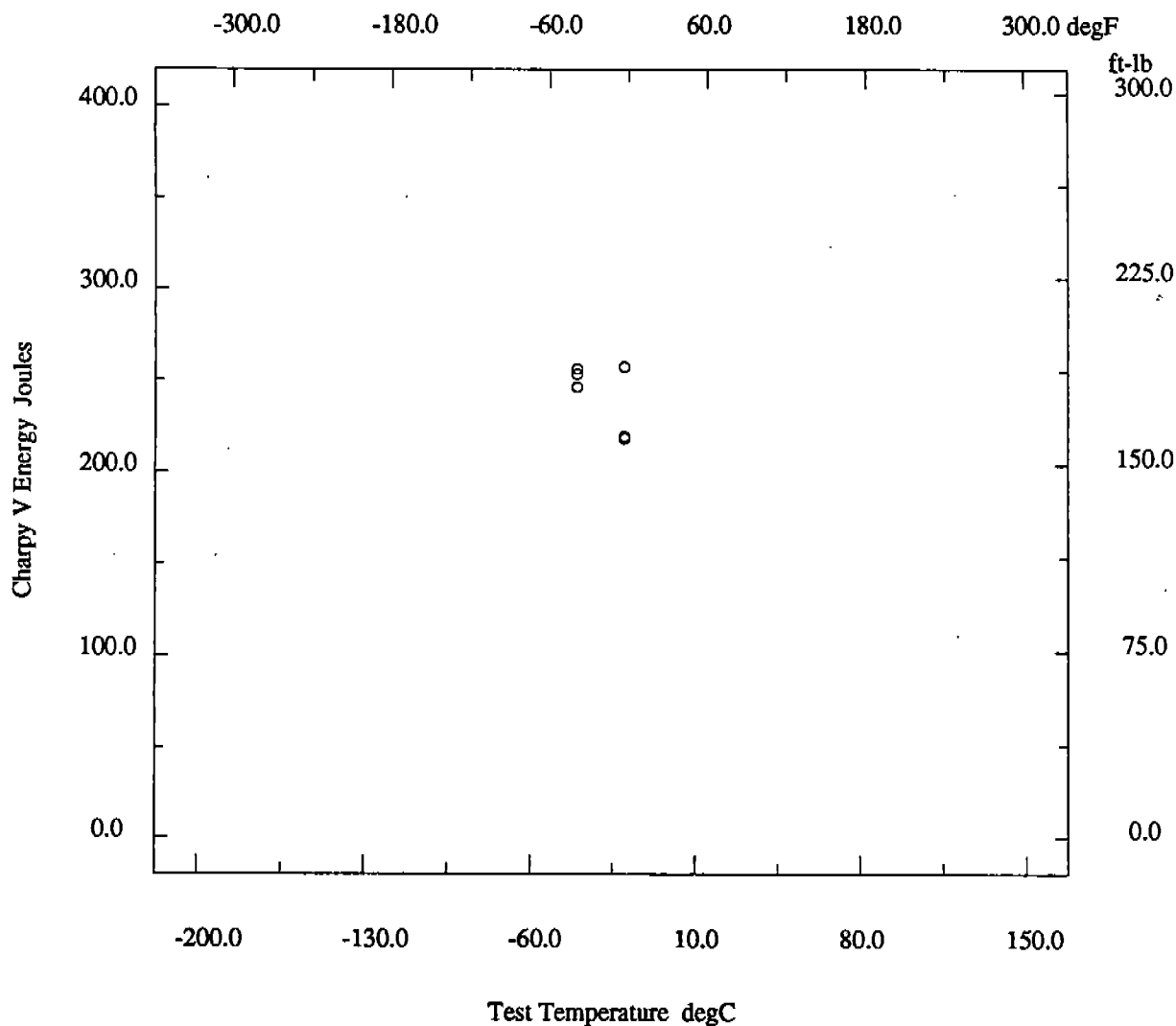
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Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.33

Description	
Material Code	010.001.05AFS
Material Name	BS4360 Gr50D
UNS	*
Other Designation	BS4360 Gr50D
Type	Welded Joint
Form	Plate
Thickness	25 mm
Composition Type	Yes
Composition Position	1/4T
Lot ID	*
Reference	SHI-01



* - not reported

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Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.34

Description			
Material Code	010.001.09ANA	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		

Composition	See Page 13800.1
--------------------	------------------

Fabrication History			
Heat Treatment	*	Producer	Sumitomo
Year Produced	*	Addl Info	None
Source	Sumitomo	Melting Practice	*
Ingot Position	*	Killing Process	*
Process Temperature	*	Process Time	*
Rolling Conditions	*	Final Processing	*
Final Temperature	*	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

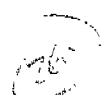
Weld			
Weld Code	010.001.09ANA	Weld Type	SMA
Base Metal Thickness	25 mm	Welding Position	Downhand
Preheat Temperature	100 degC	Metal Gap	3 mm
Interpass Temperature	250 degC	Passes	*
Filler Specification	*	Filler Name	L-50N
Filler Carbon Content	*	Filler Metal Size	3.2 mm
Shielding Gas	*	Voltage	24 volts
Amperage	100-140 amps	Polarity	*
Travel Speed	15-20 cm/min	Heat Input/Pass	12.5 KJ/cm
Joint Preparation	1/2 V-Groove	Number of Sides	2
Location wrt Weld	11mm in HAZ	Location wrt Surface	Full cross section
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		

Property Measurements			
Test Type	Fracture Toughness	Position	*
Orientation	*	Specimen Type	*
Specimen Thickness	25 mm	Crack Length	*
Loading Type	*	Loading Rate	*
KQ	*	KIc	*
Valid KIc?	*	Reason for Invalid	*
JIc	*	KJc	*
JIcpr	*	Initial COD	*
Curve Shape	*	Initial JI, JI	*
Maximum J, Jmax	*	Tearing Modulus	*
Standard Method	BS5762	Standard Year	*

Test Temp degC	CODIc mm
-30	0.57
-30	0.68
-30	1.26

* - not reported

(continued)



Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.35

(continued)

Test Temp degC	CODIc mm
-10	1.42
-10	1.50
-10	1.54

* - not reported

Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.36

Description			
Material Code	010.001.02ANA	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Welded Joint	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		

Composition See Page 13800.1

Fabrication History See Page 13800.34

Weld			
Weld Code	010.001.02ANA	Weld Type	SMA
Base Metal Thickness	25 mm	Welding Position	Downhand
Preheat Temperature	100 degC	Metal Gap	3 mm
Interpass Temperature	250 degC	Passes	*
Filler Specification	*	Filler Name	L-50N
Filler Carbon Content	*	Filler Metal Size	3.2 mm
Shielding Gas	*	Voltage	24 volts
Amperage	100-140 amps	Polarity	*
Travel Speed	15-20 cm/min	Heat Input/Pass	12.5 KJ/cm
Joint Preparation	1/2 V-Groove	Number of Sides	2
Location wrt Weld	Fusion line	Location wrt Surface	Full cross section
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	No		

Property Measurements			
Test Type	Fracture Toughness	Position	*
Orientation	*	Specimen Type	*
Specimen Thickness	25 mm	Crack Length	*
Loading Type	*	Loading Rate	*
KQ	*	KIc	*
Valid KIc?	*	Reason for Invalid	*
JIc	*	KJc	*
JIcpr	*	Initial COD	*
Curve Shape	*	Initial JI, JI	*
Maximum J, Jmax	*	Tearing Modulus	*
Standard Method	BS5762	Standard Year	*

Test Temp degC	CODIc mm
-30	0.17
-30	0.29
-30	0.80
-10	0.49
-10	0.85
-10	1.31

* - not reported



Marine Structural Toughness Data Bank

Material BS4360 Gr50D

Page 13800.37

Description			
Material Code	010.001.010A	Material Name	BS4360 Gr50D
UNS	*	Other Designation	BS4360 Gr50D
Type	Wrought Metal	Form	Plate
Thickness	25 mm	Composition Type	Yes
Composition Position	1/4T	Lot ID	*
Reference	SHI-01		

Composition	See Page 13800.1
--------------------	------------------

Fabrication History	See Page 13800.34
----------------------------	-------------------

Weld			
Weld Code	010.001.010A	Weld Type	*
Base Metal Thickness	*	Welding Position	*
Preheat Temperature	*	Metal Gap	*
Interpass Temperature	*	Passes	*
Filler Specification	*	Filler Name	*
Filler Carbon Content	*	Filler Metal Size	*
Shielding Gas	*	Voltage	*
Amperage	*	Polarity	*
Travel Speed	*	Heat Input/Pass	*
Joint Preparation	*	Number of Sides	*
Location wrt Weld	*	Location wrt Surface	*
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	*		

Property Measurements			
Test Type	Fracture Toughness	Position	*
Orientation	*	Specimen Type	*
Specimen Thickness	25 mm	Crack Length	*
Loading Type	*	Loading Rate	*
KQ	*	KIc	*
Valid KIc?	*	Reason for Invalid	*
JIc	*	KIc	*
JIcpr	*	Initial COD	*
Curve Shape	*	Initial JI, JI	*
Maximum J, Jmax	*	Tearing Modulus	*
Standard Method	BS5762	Standard Year	*

Test Temp degC	CODIc mm
-30	>4.03
-30	>4.04
-30	>4.15

* - not reported

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Marine Structural Toughness Data Bank

Material HY80

Page 16500.1

Description			
Material Code	001.001.09B	Material Name	HY80
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	50 mm	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	WJ,3/87		
Composition			
C	0.060 %	Mn	1.17 %
P	0.013 %	S	0.006 %
Si	0.32 %	Cr	0.15 %
Ni	1.80 %	Mo	0.40 %
V	0.026 %	Cu	0.020 %
Cb	*	Ti	*
B	*	Al	*
N	*	Other Components	*
Fabrication History			
Heat Treatment	*	Producer	Bunge
Year Produced	*	Addl Info	None
Source	P&EStat	Melting Practice	*
Ingot Position	*	Killing Process	*
Process Temperature	*	Process Time	*
Rolling Conditions	*	Final Processing	*
Final Temperature	*	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*
Weld			
Weld Code	001.001.09B	Weld Type	SMA
Base Metal Thickness	32 mm	Welding Position	Downhand
Preheat Temperature	150 degC	Metal Gap	0 mm
Interpass Temperature	150 degC	Passes	>40
Filler Specification	E10018	Filler Name	*
Filler Carbon Content	0.06 %	Filler Metal Size	4 mm
Shielding Gas	*	Voltage	23-26 volts
Amperage	160-200 amps	Polarity	DC
Travel Speed	160-300 mm/min	Heat Input/Pass	25 KJ/cm
Joint Preparation	Double V-Groove	Number of Sides	2
Location wrt Weld	11mm in HAZ	Location wrt Surface	*
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	Basic	Flux Name	*
Weld Composition Reported?	Yes		

* - not reported

(continued)

Marine Structural Toughness Data Bank

Material HY80

Page 16500.2

(continued)

Property Measurements						
Test Type	Tensile	Position	.....		*
Specimen Type	Cylindrical	Specimen Thickness	.....	5.9 mm	
Gage Length	23.6 mm	Loading Rate	.....		*
Tensile Strength Offset	*	Uniform Elongation	.....		*
Tensile Modulus	*	Standard Method	.....	E 8	
Standard Year	1981				
Orient	Test Temp degC	UTS MPa	TYS MPa	TYP MPa	Elongation %	RA %
L	-18	793	738	*	21.5	62

* - not reported

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Marine Structural Toughness Data Bank

Material HY80

Page 16500.3

Description			
Material Code	001.001.09B	Material Name	HY80
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	50 mm	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	WJ.3/87		

Composition See Page 16500.1

Fabrication History See Page 16500.1

Weld See Page 16500.1

Property Measurements

Test Type	Charpy V Impact	Position	0/4T
Specimen Type	Full	Lateral Expansion	*
Shear Fracture	*	Did Specimen Fracture?	Assumed
Did Specimen Split?	*	Standard Method	E 23
Standard Year	1981		

Orien	Test Temp degC	CVN Energy Joules
T-L ◦	-40	65
T-L ◦	-40	70
T-L ◦	-40	81
T-L ◦	-18	105
T-L ◦	-18	110
T-L ◦	-18	119
T-L ◦	0	111
T-L ◦	0	117
T-L ◦	0	119

* - not reported

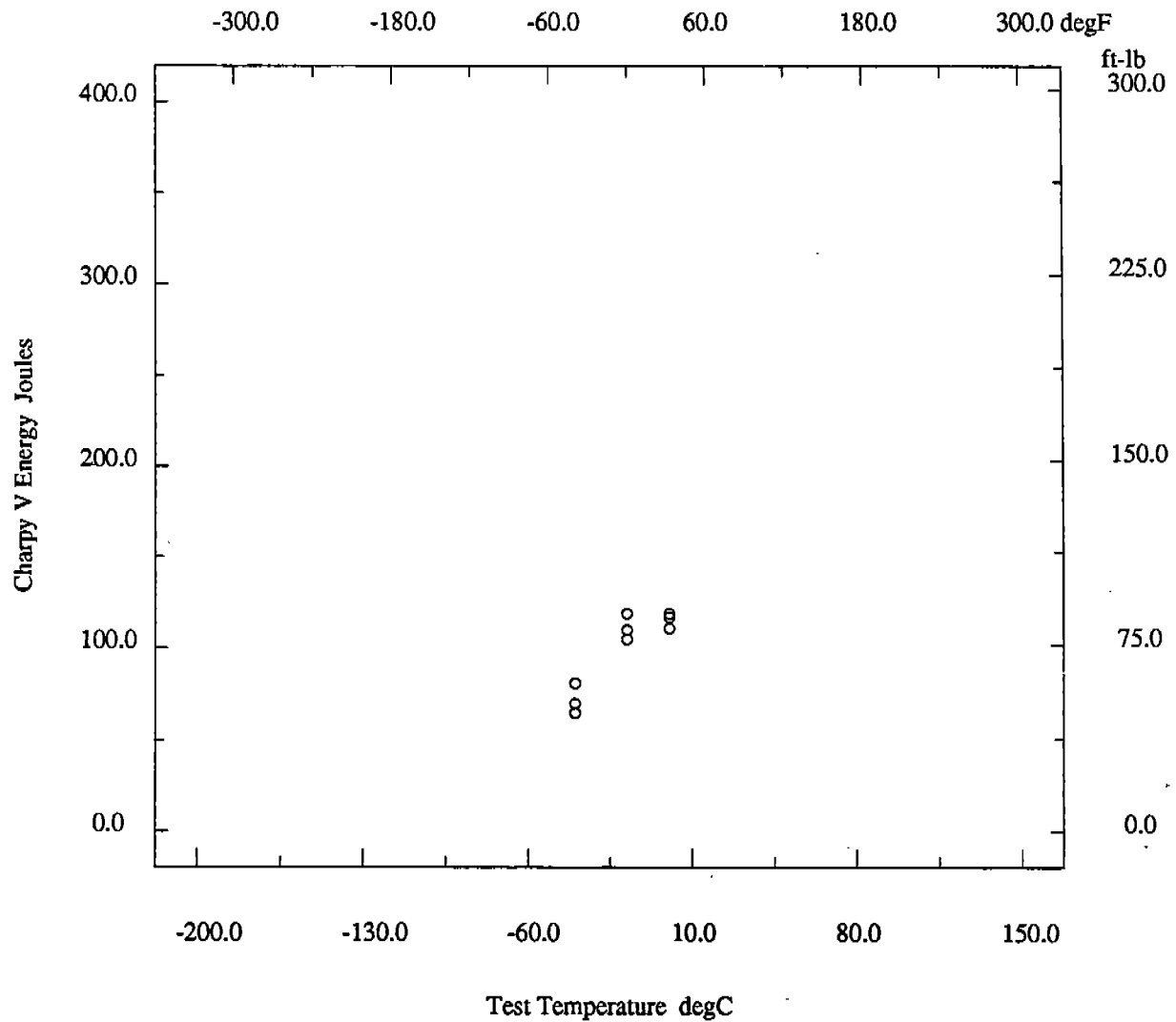


Marine Structural Toughness Data Bank

Material HY80

Page 16500.4

Description			
Material Code	001.001.09B	Material Name	HY80
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	50 mm	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	WJ,3/87		



* - not reported

C

Marine Structural Toughness Data Bank

Material HY80

Page 16500.5

Description							
Material Code	001.001.09F	Material Name	HY80				
UNS	*	Other Designation	*				
Type	Welded Joint	Form	Plate				
Thickness	50 mm	Composition Type	Actual				
Composition Position	*	Lot ID	*				
Reference	WJ,3/87						
Composition							
C	0.080 %	Mn	1.24 %				
P	0.013 %	S	0.007 %				
Si	0.44 %	Cr	0.13 %				
Ni	2.10 %	Mo	0.40 %				
V	0.017 %	Cu	0.020 %				
Cb	*	Ti	*				
B	*	Al	*				
N	*	Other Components	*				
Fabrication History		See Page 16500.1					
Weld							
Weld Code	001.001.09F	Weld Type	SMA				
Base Metal Thickness	32 mm	Welding Position	Downhand				
Preheat Temperature	150 degC	Metal Gap	0 mm				
Interpass Temperature	150 degC	Passes	>40				
Filler Specification	E10018	Filler Name	*				
Filler Carbon Content	0.08 %	Filler Metal Size	4 mm				
Shielding Gas	*	Voltage	23-26 volts				
Amperage	160-200 amps	Polarity	DC				
Travel Speed	160-300 mm/min	Heat Input/Pass	25 KJ/cm				
Joint Preparation	Double V-Groove	Number of Sides	2				
Location wrt Weld	11mm in HAZ	Location wrt Surface	*				
Post-Weld Heat Temp	*	Post-Weld Heat Time	*				
Flux Type	Basic	Flux Name	*				
Weld Composition Reported?	Yes						
Property Measurements							
Test Type	Tensile	Position	*				
Specimen Type	Cylindrical	Specimen Thickness	5.9 mm				
Gage Length	23.6 mm	Loading Rate	*				
Tensile Strength Offset	*	Uniform Elongation	*				
Tensile Modulus	*	Standard Method	E 8				
Standard Year	1981						
Orient	Test Temp degC	UTS MPa	TYS MPa	TYP MPa	Elongation %	RA %	
L	-18	751	644	*	28.0	68	

* - not reported



Marine Structural Toughness Data Bank

Material HY80

Page 16500.6

Description	
Material Code	001.001.09F
Material Name	HY80
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	50 mm
Composition Type	Actual
Composition Position	*
Lot ID	*
Reference	WJ,3/87
Composition	See Page 16500.5
Fabrication History	See Page 16500.1
Weld	See Page 16500.5
Property Measurements	
Test Type	Charpy V Impact
Position	0/4T
Specimen Type	Full
Lateral Expansion	*
Shear Fracture	*
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	E 23
Standard Year	1981

Orien	Test Temp degC	CVN Energy Joules
T-L ◦	-40	101
T-L ◦	-40	103
T-L ◦	-40	96
T-L ◦	-18	103
T-L ◦	-18	111
T-L ◦	0	122
T-L ◦	0	124
T-L ◦	0	126

* - not reported

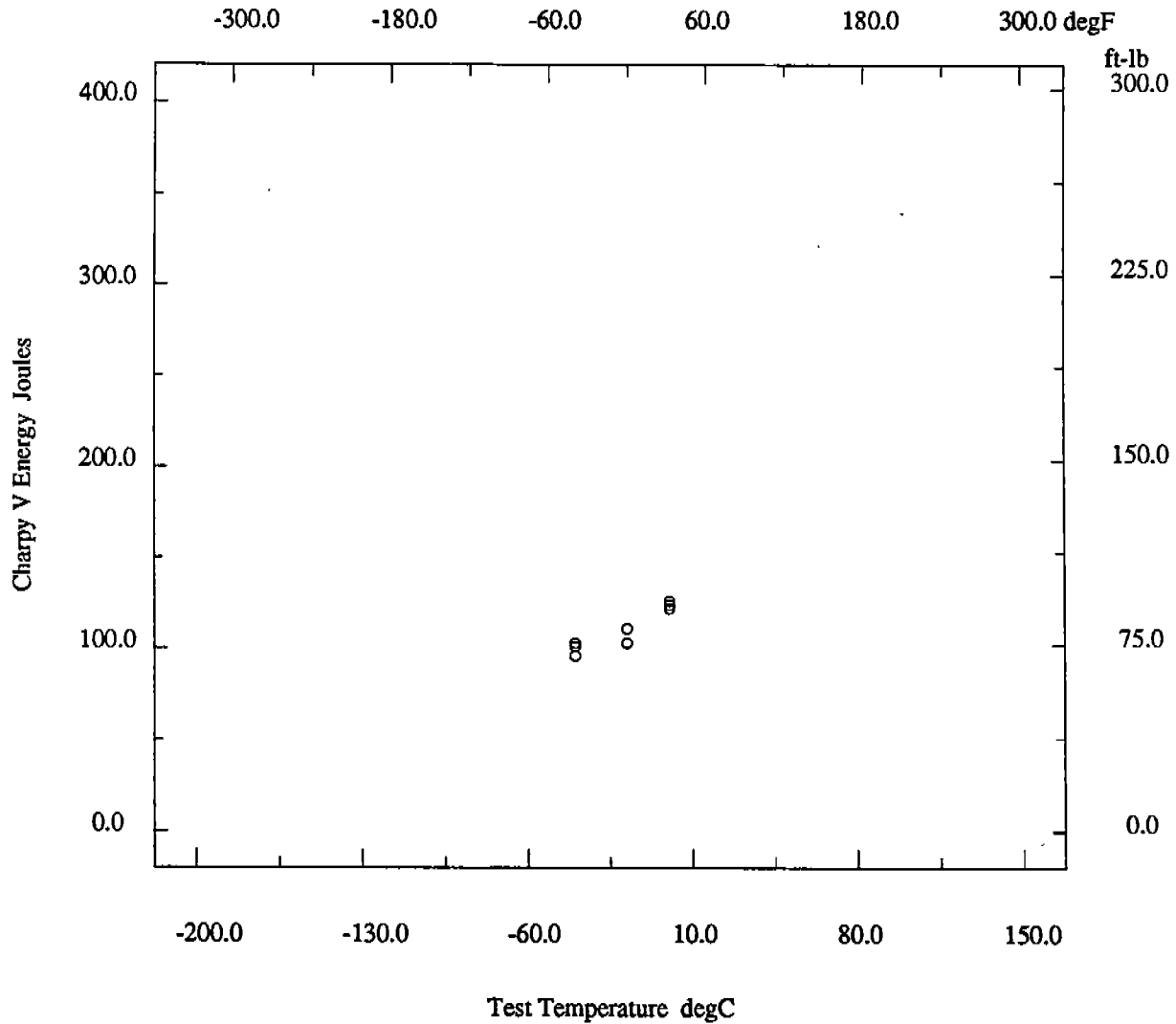
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Marine Structural Toughness Data Bank

Material HY80

Page 16500.7

Description			
Material Code	001.001.09F	Material Name	HY80
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	50 mm	Composition Type	Actual
Composition Position	*	Lot ID	*
Reference	WJ,3/87		



* - not reported



Marine Structural Toughness Data Bank

Material HY80

Page 16600.1

Description	
Material Code	001.002.01
Material Name	HY80
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	1.5 in
Composition Type	Actual
Composition Position	*
Lot ID	B9353-3
Reference	1120

Composition			
C	0.17 %	Mn	0.28 %
P	0.007 %	S	0.013 %
Si	0.20 %	Cr	1.29 %
Ni	2.48 %	Mo	0.30 %
V	0.003 %	Cu	0.18 %
Cb	*	Ti	0.003 %
B	*	Al	*
N	*	Other Components	fgp,Al %

Fabrication History	
Heat Treatment	*
Producer	Lukens
Year Produced	1977
Addl Info	None
Source	Lukens
Melting Practice	*
Ingot Position	*
Killing Process	*
Process Temperature	*
Process Time	*
Rolling Conditions	*
Final Processing	*
Final Temperature	*
Final Time	*
Cold Work Strain	*
Aging Temperature	*
Aging Time	*
Location	*

Property Measurements			
Test Type	Fracture Toughness	Position	*
Specimen Type	*	Specimen Thickness	1.5 in
Crack Length	*	Loading Type	*
Loading Rate	*	KQ	*
KIc	*	Valid KIc?	*
Reason for Invalid	*	JIc	*
KJc	*	JIcpr	*
Curve Shape	*	Standard Method	*
Standard Year	*		

Orien	Test Temp degF	CODi in	CODIc in	JI in-lb/in**2	Jmax in-lb/in**2	Tear Mod in-lb/in**2
L-T	72	0.0236	0.0380	4346	4315	260.2
L-T	72	0.0186	0.0349	3841	4195	306.1
T-L	72	0.0167	0.0251	2568	2923	230.8
T-L	75	0.0171	0.0253	2724	2841	218.4
S-L	72	0.0118	0.0196	1786	2098	181.7
S-L	*	0.0131	0.0220	1971	2465	229.8

* - not reported



Marine Structural Toughness Data Bank

Material HY80

Page 16600.2

Description	
Material Code	001.002.01
Material Name	HY80
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	1.5 in
Composition Type	Actual
Composition Position	*
Lot ID	B9353-3
Reference	1120

Composition See Page 16600.1

Fabrication History See Page 16600.1

Property Measurements	
Test Type	Charpy V Impact
Position	*
Specimen Type	*
Did Specimen Fracture?	*
Did Specimen Split?	*
Standard Method	*
Standard Year	*

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
L-T ◯	-320	6	2	5
L-T ◯	-255	24	12	16
L-T ◯	-250	23	12	11
L-T ◯	-240	25	15	17
L-T ◯	-230	33	20	24
L-T ◯	-220	24	15	21
L-T ◯	-210	27	16	27
L-T ◯	-200	35	26	36
L-T ◯	-180	46	32	42
L-T ◯	-160	55	40	55
L-T ◯	-140	61	46	72
L-T ◯	-120	73	55	88
L-T ◯	-100	79	57	95
L-T ◯	-80	80	62	100
L-T ◯	-60	83	63	100
L-T ◯	-40	84	64	100
L-T ◯	-20	88	69	100
L-T ◯	0	90	67	100
L-T ◯	20	82	62	100
L-T ◯	76	86	70	100
T-L ▲	-320	6	2	5
T-L ▲	-255	28	14	11
T-L ▲	-240	38	21	19
T-L ▲	-220	45	27	30
T-L ▲	-210	66	44	44
T-L ▲	-200	96	58	60
T-L ▲	-190	70	45	52
T-L ▲	-180	85	54	55
T-L ▲	-160	97	63	77
T-L ▲	-150	107	69	85
T-L ▲	-140	119	78	90
T-L ▲	-120	122	80	100
T-L ▲	-100	121	81	100
T-L ▲	-80	136	88	100

* - not reported

(continued)

Marine Structural Toughness Data Bank

Material HY80

Page 16600.3

(continued)

Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %
T-L ^Δ	-60	130	79	100
T-L ^Δ	-40	140	87	100
T-L ^Δ	-20	139	87	100
T-L ^Δ	0	132	86	100
T-L ^Δ	20	136	88	100
T-L ^Δ	76	137	90	100

* - not reported

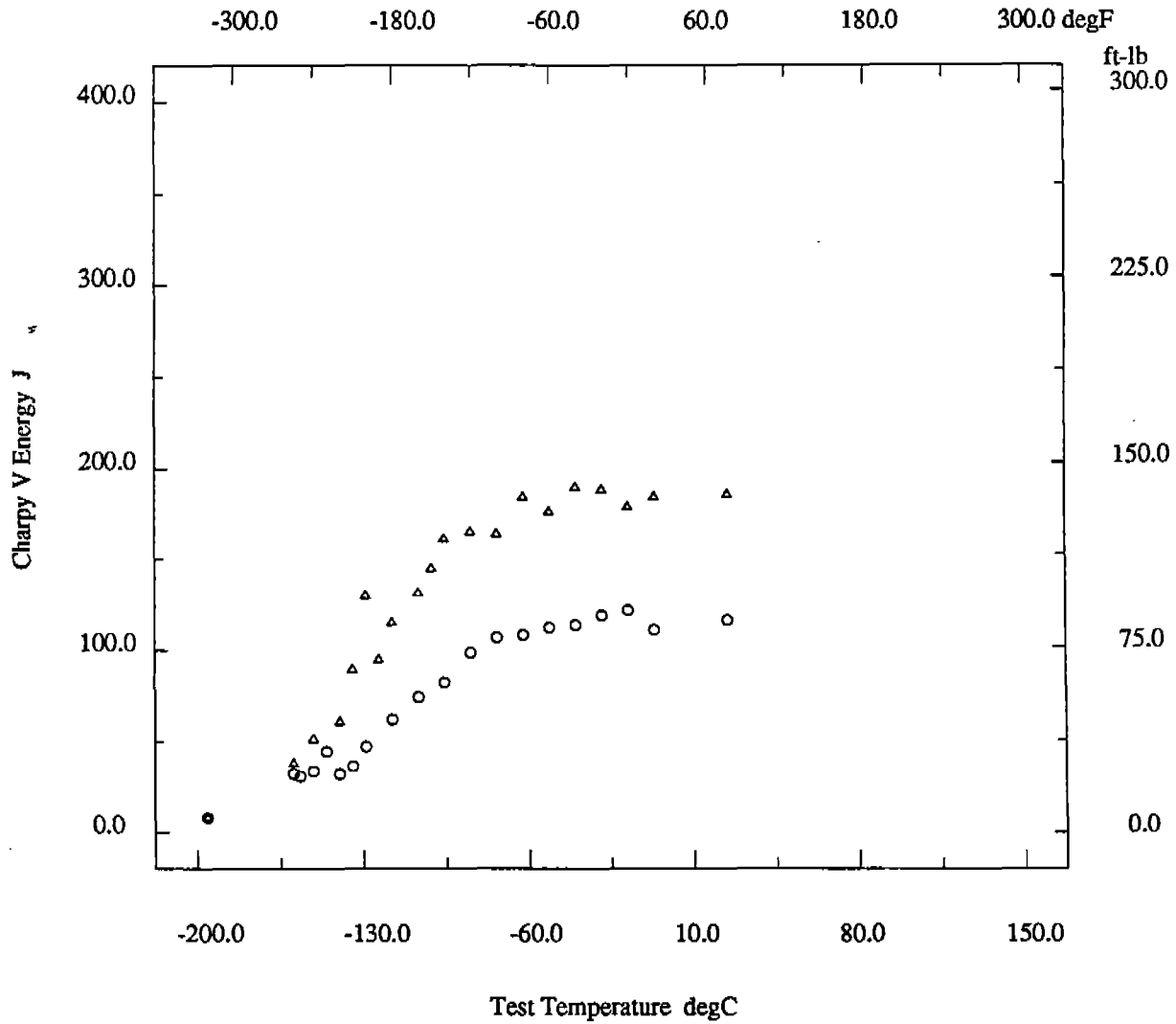


Marine Structural Toughness Data Bank

Material HY80

Page 16600.4

Description				
Material Code	001.002.01	Material Name	HY80	
UNS	*	Other Designation	*	
Type	Wrought Metal	Form	Plate	
Thickness	1.5 in	Composition Type	Actual	
Composition Position	*	Lot ID	B9353-3	
Reference	1120			



* - not reported

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Marine Structural Toughness Data Bank

Material HY80

Page 16600.5

Description	
Material Code	001.002.01
Material Name	HY80
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	1.5 in
Composition Type	Actual
Composition Position	*
Lot ID	B9353-3
Reference	1120

Composition See Page 16600.1

Fabrication History See Page 16600.1

Property Measurements	
Test Type	Tensile
Position	*
Specimen Type	*
Specimen Thickness	*
Gage Length	*
Loading Rate	*
Tensile Strength Offset	*
Tensile Yield Point	*
Uniform Elongation	*
Tensile Modulus	*
Standard Method	*
Standard Year	*

Orient	Test Temp degF	UTS ksi	TYS ksi	Elongation %	RA %
L	80	106.8	92.2	23.8	72.1
L	80	106.8	93.2	23.7	72.1
T	80	106.8	86.7	24.3	76.6
T	80	107.3	90.7	23.9	75.4

* - not reported



Marine Structural Toughness Data Bank

Material HY80

Page 16600.6

Description	
Material Code 001.002.01	Material Name HY80
UNS *	Other Designation *
Type Wrought Metal	Form Plate
Thickness 1.5 in	Composition Type Actual
Composition Position *	Lot ID B9353-3
Reference 1120	

Composition See Page 16600.1

Fabrication History See Page 16600.1

Property Measurements	
Test Type Dynamic Tear	Position *
Specimen Type Dynamic Tear	Notch Preparation *
Specimen Thickness 0.625 in	Loading Rate *
Standard Method *	Standard Year *

Orien	Test Temp degF	DT Energy ft-lb	Frac Apear %
L-T ◯	-225	35	5
L-T ◯	-200	40	14
L-T ◯	-175	100	22
L-T ◯	-150	215	33
L-T ◯	-125	265	42
L-T ◯	-110	515	69
L-T ◯	-100	570	79
L-T ◯	-75	690	99
L-T ◯	-50	695	100
L-T ◯	-25	720	100
T-L ▲	-225	30	10
T-L ▲	-200	40	13
T-L ▲	-175	95	22
T-L ▲	-150	260	38
T-L ▲	-135	510	52
T-L ▲	-125	635	64
T-L ▲	-100	860	77
T-L ▲	-75	1100	88
T-L ▲	-50	1390	100
T-L ▲	-25	1400	100

* - not reported

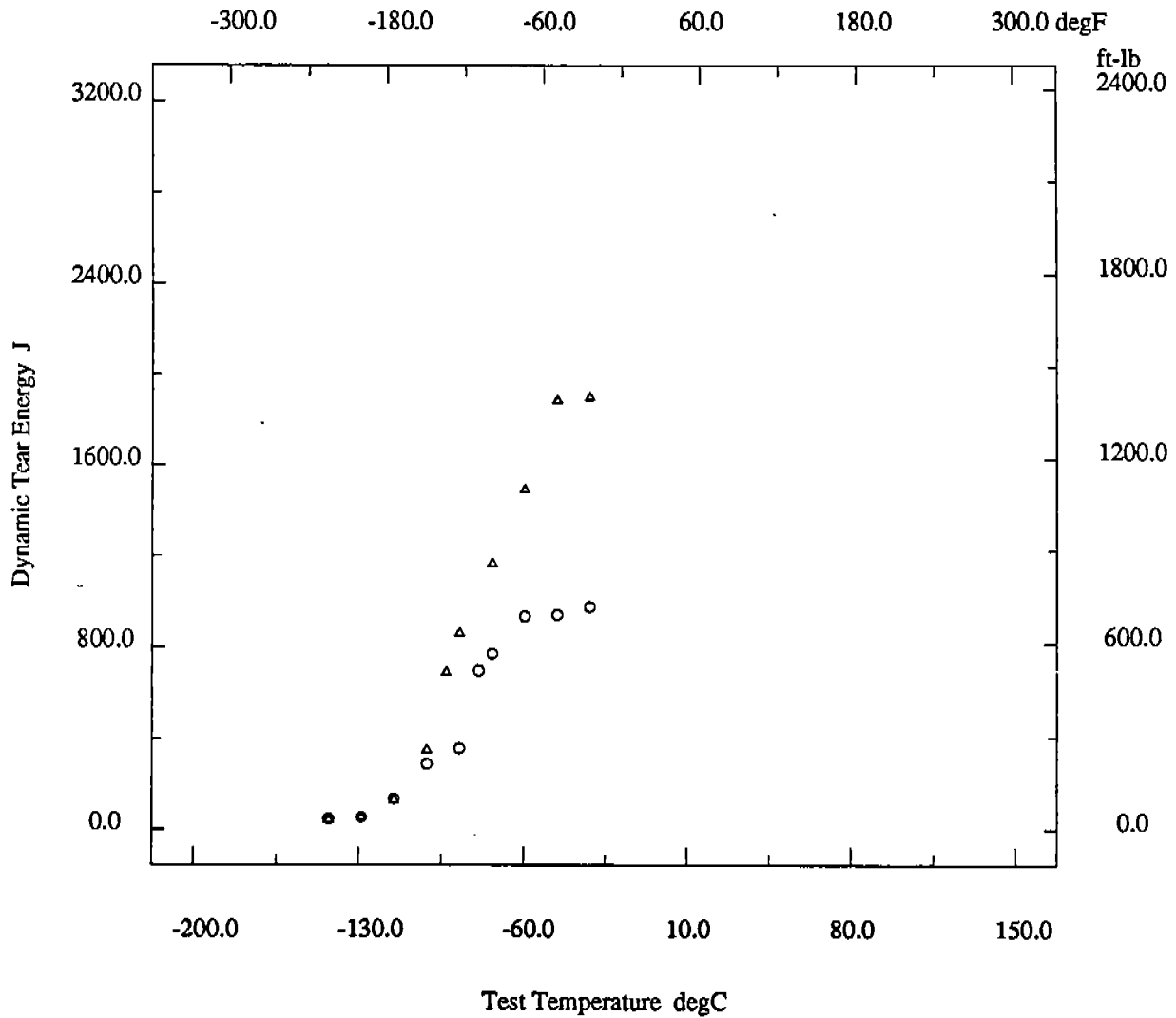


Marine Structural Toughness Data Bank

Material HY80

Page 16600.7

Description	
Material Code	001.002.01
Material Name	HY80
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	1.5 in
Composition Type	Actual
Composition Position	*
Lot ID	B9353-3
Reference	1120



* - not reported

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Marine Structural Toughness Data Bank

Material HY100

Page 19500.2

Description	
Material Code	011.001.01
Material Name	HY100
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	2 in
Composition Type	Actual
Composition Position	*
Lot ID	B5761-2R
Reference	3530

Composition See Page 19500.1

Fabrication History See Page 19500.1

Property Measurements	
Test Type	Dynamic Tear
Specimen Type	Dynamic Tear
Notch Preparation	Pressed
Specimen Thickness	0.625 in
Loading Rate	*
Standard Method	*
Standard Year	*

Position	Orien	Test Temp degF	DT Energy ft-lb	Frac Apear %
0/4T	L-T ◯	-240	100	3
1/2T	L-T ◯	-240	220	8
0/4T	L-T ◯	-220	95	6
1/2T	L-T ◯	-220	95	11
0/4T	L-T ◯	-180	90	9
1/2T	L-T ◯	-180	100	19
0/4T	L-T ◯	-160	180	27
1/2T	L-T ◯	-160	220	45
0/4T	L-T ◯	-140	265	37
1/2T	L-T ◯	-140	450	72
0/4T	L-T ◯	-120	320	47
1/2T	L-T ◯	-120	620	81
0/4T	L-T ◯	-80	840	100
1/2T	L-T ◯	-80	790	100
0/4T	L-T ◯	-40	760	100
1/2T	L-T ◯	-40	810	100
0/4T	L-T ◯	0	815	100
1/2T	L-T ◯	0	820	100
0/4T	L-T ◯	30	875	100
1/2T	L-T ◯	30	925	100
0/4T	T-L ▲	-240	45	3
1/2T	T-L ▲	-240	80	3
0/4T	T-L ▲	-220	75	6
1/2T	T-L ▲	-220	150	14
0/4T	T-L ▲	-180	90	17
1/2T	T-L ▲	-180	150	23
0/4T	T-L ▲	-160	95	16
1/2T	T-L ▲	-160	140	34
0/4T	T-L ▲	-140	125	30
1/2T	T-L ▲	-140	195	51
0/4T	T-L ▲	-120	200	50
1/2T	T-L ▲	-120	270	64
0/4T	T-L ▲	-80	325	100
1/2T	T-L ▲	-80	420	100

* - not reported

(continued)

Marine Structural Toughness Data Bank

Material HY100

Page 19500.1

Description	
Material Code	011.001.01
Material Name	HY100
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	2 in
Composition Type	Actual
Composition Position	*
Lot ID	B5761-2R
Reference	3530

Composition			
C	0.17 %	Mn	0.40 %
P	0.007 %	S	0.019 %
Si	0.31 %	Cr	1.75 %
Ni	3.14 %	Mo	0.53 %
V	0.01 %	Cu	0.21 %
Cb	*	Ti	*
B	*	Al	0.05 %
N	*	Other Components	None %

Fabrication History			
Heat Treatment	Q,T	Producer	Lukens
Year Produced	1982	Addl Info	None
Source	Lukens	Melting Practice	*
Ingot Position	*	Killing Process	*
Process Temperature	1650 degF	Process Time	*
Rolling Conditions	*	Final Processing	Q,T
Final Temperature	1050 degF	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*

Property Measurements			
Test Type	Tensile	Specimen Type	*
Specimen Thickness	*	Gage Length	*
Loading Rate	*	Tensile Strength Offset	*
Tensile Yield Point	*	Uniform Elongation	*
Tensile Modulus	*	Standard Method	*
Standard Year	*		

Position	Orient	Test Temp degF	UTS ksi	TYS ksi	Elongation %	RA %
0/4T	L	75	123.3	110.1	22	71.6
0/4T	L	75	123.3	110.2	22	71.6
0/4T	L	75	123.3	110.3	22	71.6
1/2T	L	75	122.6	109.3	21	71.0
1/2T	L	75	122.8	109.4	21	71.1
1/2T	L	75	123.1	109.5	21	71.3
0/4T	T	75	123.6	109.8	19	58.6
0/4T	T	75	123.7	110.3	19	58.7
0/4T	T	75	123.8	110.8	19	58.8
1/2T	T	75	122.8	109.6	20	59.8
1/2T	T	75	122.9	109.3	20	59.8
1/2T	T	75	123.1	109.1	20	59.8

* - not reported



Marine Structural Toughness Data Bank

Material HY100

Page 19500.3

(continued)

Position	Orien	Test Temp degF	DT Energy ft-lb	Frac Apear %
0/4T	T-L ^	-40	350	100
1/2T	T-L ^	-40	475	100
0/4T	T-L ^	0	600	100
1/2T	T-L ^	0	470	100
0/4T	T-L ^	30	410	100
1/2T	T-L ^	30	500	100

* - not reported

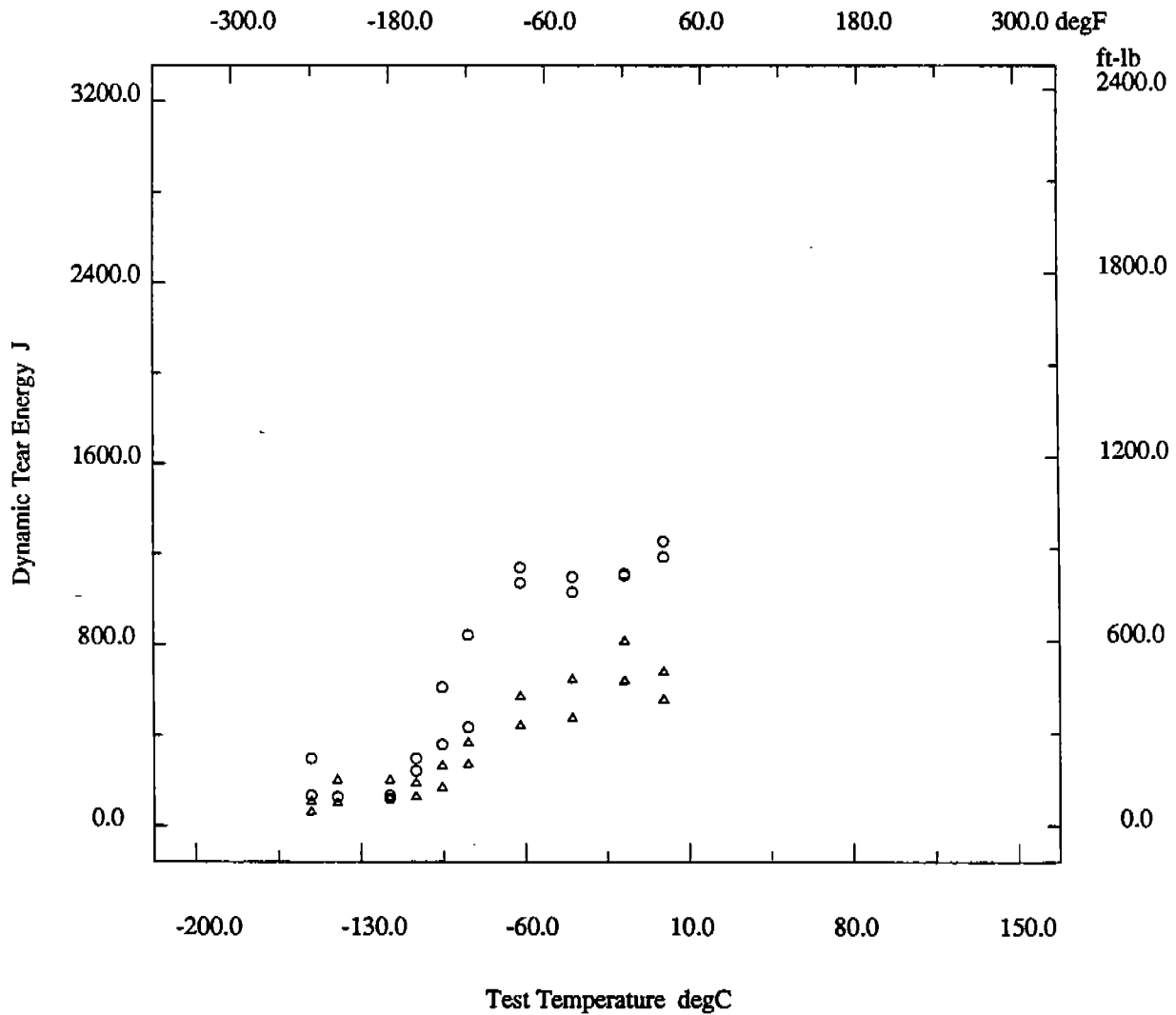
10/11

Marine Structural Toughness Data Bank

Material HY100

Page 19500.4

Description			
Material Code	011.001.01	Material Name	HY100
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	2 in	Composition Type	Actual
Composition Position	*	Lot ID	B5761-2R
Reference	3530		



* - not reported



Marine Structural Toughness Data Bank

Material HY100

Page 19500.5

Description	
Material Code	011.001.01
Material Name	HY100
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	2 in
Composition Type	Actual
Composition Position	*
Lot ID	B5761-2R
Reference	3530

Composition See Page 19500.1

Fabrication History See Page 19500.1

Property Measurements	
Test Type	Charpy V Impact
Specimen Type	Full
Did Specimen Fracture?	*
Standard Method	*
Standard Year	*

Position	Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %	Split?
0/4T	L-T ◯	-320	8	2	6	No
1/2T	L-T ◯	-320	8	2	8	No
0/4T	L-T ◯	-255	23	8	12	No
1/2T	L-T ◯	-255	33	15	21	No
0/4T	L-T ◯	-240	21	10	14	No
1/2T	L-T ◯	-240	22	9	21	No
1/2T	L-T ◯	-230	36	20	32	Yes
0/4T	L-T ◯	-220	29	12	19	No
1/2T	L-T ◯	-220	50	29	46	Yes
0/4T	L-T ◯	-200	35	19	30	No
1/2T	L-T ◯	-200	54	32	48	Yes
0/4T	L-T ◯	-180	42	24	38	No
1/2T	L-T ◯	-180	67	41	75	Yes
0/4T	L-T ◯	-170	46	29	50	No
0/4T	L-T ◯	-160	53	35	55	No
1/2T	L-T ◯	-160	71	46	77	Yes
0/4T	L-T ◯	-140	62	40	65	Yes
1/2T	L-T ◯	-140	85	57	94	Yes
0/4T	L-T ◯	-120	80	53	99	Yes
1/2T	L-T ◯	-120	88	58	99	Yes
0/4T	L-T ◯	-90	80	52	100	Yes
1/2T	L-T ◯	-90	99	63	100	Yes
0/4T	L-T ◯	-60	86	58	100	Yes
1/2T	L-T ◯	-60	100	66	100	Yes
0/4T	L-T ◯	0	85	56	100	Yes
1/2T	L-T ◯	0	101	63	100	Yes
0/4T	L-T ◯	30	87	65	100	Yes
1/2T	L-T ◯	30	106	66	100	Yes
0/4T	L-T ◯	74	85	64	100	Yes
1/2T	L-T ◯	74	103	73	100	Yes
0/4T	T-L △	-320	10	2	8	No
1/2T	T-L △	-320	8	2	8	No
0/4T	T-L △	-255	19	6	11	No
1/2T	T-L △	-255	18	6	18	No
0/4T	T-L △	-240	9	6	11	No

* - not reported

(continued)

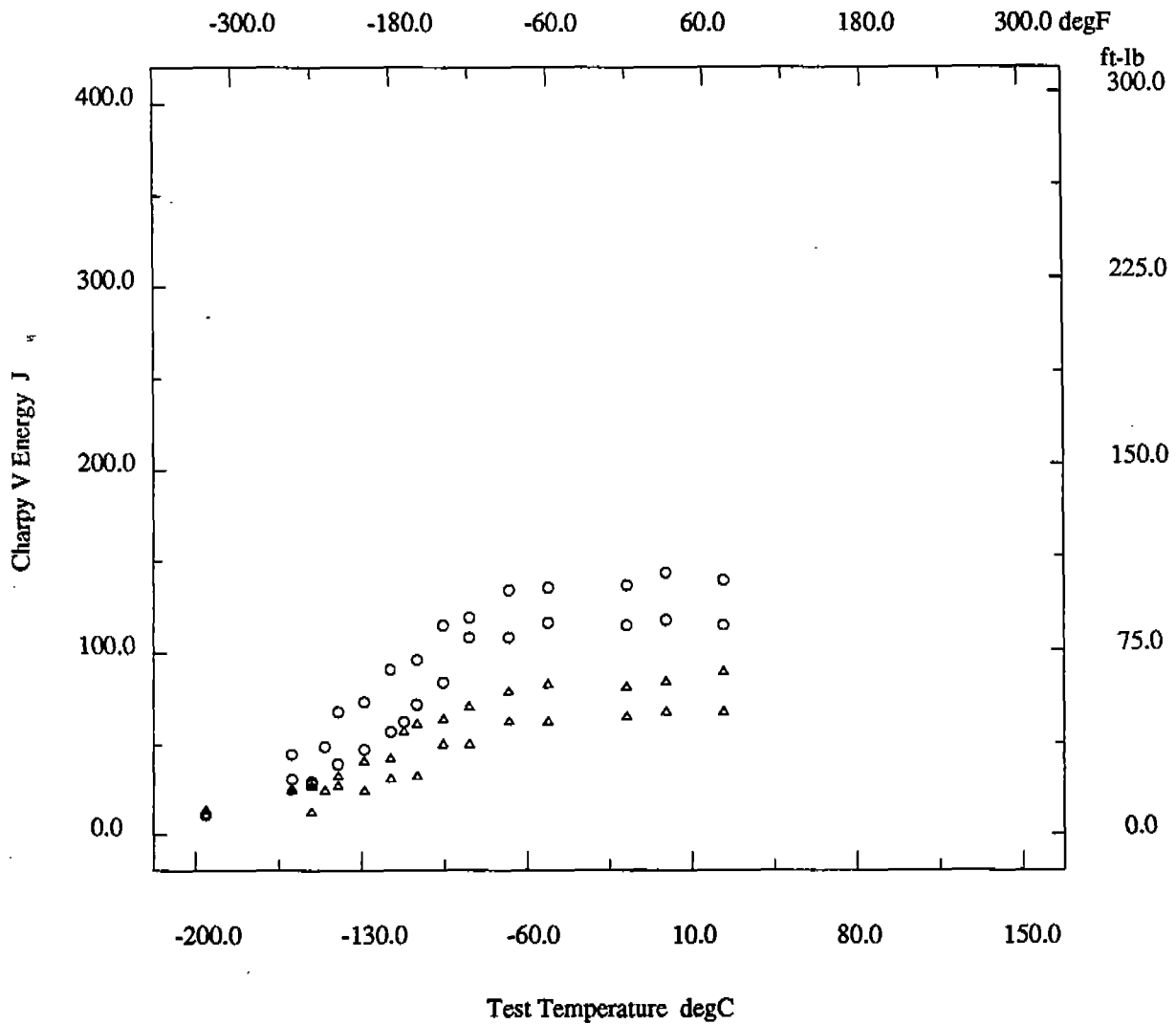
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Marine Structural Toughness Data Bank

Material HY100

Page 19500.7

Description			
Material Code	011.001.01	Material Name	HY100
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	2 in	Composition Type	Actual
Composition Position	*	Lot ID	B5761-2R
Reference	3530		



* - not reported

2910x

Marine Structural Toughness Data Bank

Material HY100

Page 19500.6

(continued)

Position	Orien	Test Temp degF	CVN Energy ft-lb	Lat Expans mils	Shear %	Split?
1/2T	T-L ^	-240	20	9	21	No
0/4T	T-L ^	-230	18	5	14	No
0/4T	T-L ^	-220	20	8	19	No
1/2T	T-L ^	-220	24	12	26	No
0/4T	T-L ^	-200	18	8	22	No
1/2T	T-L ^	-200	30	18	40	No
0/4T	T-L ^	-180	23	14	33	No
1/2T	T-L ^	-180	31	21	49	No
1/2T	T-L ^	-170	42	27	56	No
0/4T	T-L ^	-160	24	16	40	No
1/2T	T-L ^	-160	45	30	68	No
0/4T	T-L ^	-140	37	27	72	No
1/2T	T-L ^	-140	47	32	78	No
0/4T	T-L ^	-120	37	28	72	No
1/2T	T-L ^	-120	52	39	92	No
0/4T	T-L ^	-90	46	34	98	No
1/2T	T-L ^	-90	58	40	100	No
0/4T	T-L ^	-60	46	35	100	No
1/2T	T-L ^	-60	61	45	100	No
0/4T	T-L ^	0	48	36	100	No
1/2T	T-L ^	0	60	45	100	No
0/4T	T-L ^	30	50	38	100	No
1/2T	T-L ^	30	62	45	100	No
0/4T	T-L ^	74	50	42	100	No
1/2T	T-L ^	74	66	52	100	No

* - not reported



Marine Structural Toughness Data Bank

Material HY100

Page 19600.1

Description						
Material Code	011.003.01	Material Name	HY100			
UNS	*	Other Designation	*			
Type	Wrought Metal	Form	Plate			
Thickness	2.0 in	Composition Type	Actual			
Composition Position	*	Lot ID	L467OV559			
Reference	USN 6/9					
Composition						
C	0.16 %	Mn	0.70 %			
P	0.011 %	S	0.014 %			
Si	*	Cr	2.93 %			
Ni	7.02 %	Mo	0.79 %			
V	<0.001 %	Cu	0.23 %			
Cb	*	Ti	<0.01 %			
B	*	Al	*			
N	*	Other Components	None %			
Fabrication History						
Heat Treatment	Q,T	Producer	*			
Year Produced	*	Addl Info	None			
Source	USN	Melting Practice	*			
Ingot Position	*	Killing Process	*			
Process Temperature	*	Process Time	*			
Rolling Conditions	*	Final Processing	Q,T			
Final Temperature	*	Final Time	*			
Cold Work Strain	*	Aging Temperature	*			
Aging Time	*	Location	*			
Property Measurements						
Test Type	Tensile	Position	*			
Specimen Type	Cylindrical	Specimen Thickness	0.505 in			
Gage Length	2.0 in	Loading Rate	0.002 in/min			
Tensile Strength Offset	0.2 %	Uniform Elongation	*			
Tensile Modulus	29.0 ksi*10**3	Standard Method	E 8			
Standard Year	1969					
Orient	Test Temp degF	UTS ksi	TYS ksi	TYP ksi	Elongation %	RA %
T	Room	113.4	99.0	*	25	72

* - not reported



Marine Structural Toughness Data Bank

Material HY100

Page 19600.2

Description			
Material Code	011.003.01	Material Name	HY100
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	2.0 in	Composition Type	Actual
Composition Position	*	Lot ID	L467OV559
Reference	USN 6/9		
Composition		See Page 19600.1	
Fabrication History		See Page 19600.1	
Property Measurements			
Test Type	Fracture Toughness	Position	*
Specimen Type	Compact Tension	Specimen Thickness	1.0 in
Crack Length	*	Loading Type	I
Loading Rate	*	KQ	*
KIc	*	Valid KIc?	*
Reason for Invalid	*	KJc	*
Jlcp	Modified Standard	Initial COD	*
Critical COD	*	Curve Shape	*
Initial JI, JI	*	Maximum J, Jmax	*
Standard Method	813	Standard Year	*

Orien	Test Temp degF	JIc in-lb/in ²	Tear Mod in-lb/in**2
T-L	Room	773	67
T-L	Room	830	65
T-L	Room	912	64
T-L	Room	949	49

* - not reported



Marine Structural Toughness Data Bank

Material HY100

Page 19600.3

Description	
Material Code 011.003.01	Material Name HY100
UNS *	Other Designation *
Type Wrought Metal	Form Plate
Thickness 2.0 in	Composition Type Actual
Composition Position *	Lot ID L467OV559
Reference USN 6/9	
Composition	See Page 19600.1
Fabrication History	See Page 19600.1
Property Measurements	
Test Type Charpy V Impact	Position *
Specimen Type Full	Lateral Expansion *
Shear Fracture *	Did Specimen Fracture? Assumed
Did Specimen Split? *	Standard Method E 23
Standard Year 1972	

Orien	Test Temp degF	CVN Energy ft-lb
T-L ◦	-120	116
T-L ◦	-120	34

* - not reported

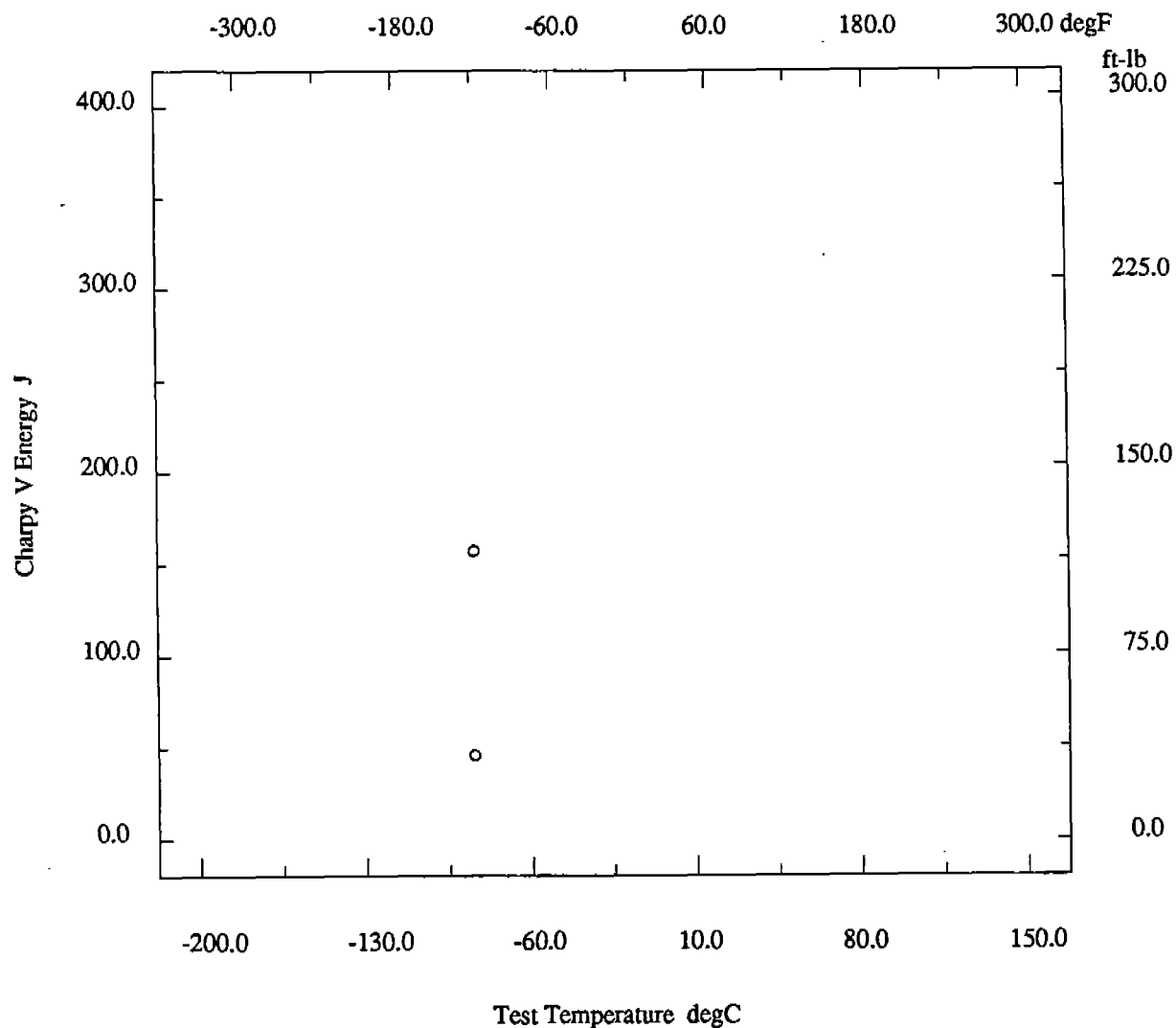


Marine Structural Toughness Data Bank

Material HY100

Page 19600.4

Description	
Material Code	011.003.01
UNS	*
Type	Wrought Metal
Thickness	2.0 in
Composition Position	*
Reference	USN 6/9
Material Name	HY100
Other Designation	*
Form	Plate
Composition Type	Actual
Lot ID	L467OV559



* - not reported

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Marine Structural Toughness Data Bank

Material HY100

Page 19600.5

Description			
Material Code	011.003.01	Material Name	HY100
UNS	*	Other Designation	*
Type	Wrought Metal	Form	Plate
Thickness	2.0 in	Composition Type	Actual
Composition Position	*	Lot ID	L467OV559
Reference	USN 6/9		

Composition See Page 19600.1

Fabrication History See Page 19600.1

Property Measurements			
Test Type	Dynamic Tear	Position	*
Specimen Type	Dynamic Tear	Notch Preparation	Pressed
Specimen Thickness	0.625 in	Loading Rate	*
Appearance	*	Standard Method	E 604
Standard Year	1980		

Orien	Test Temp degF	DT Energy ft-lb
T-L ◦	0	1085
T-L ◦	0	1220

* - not reported

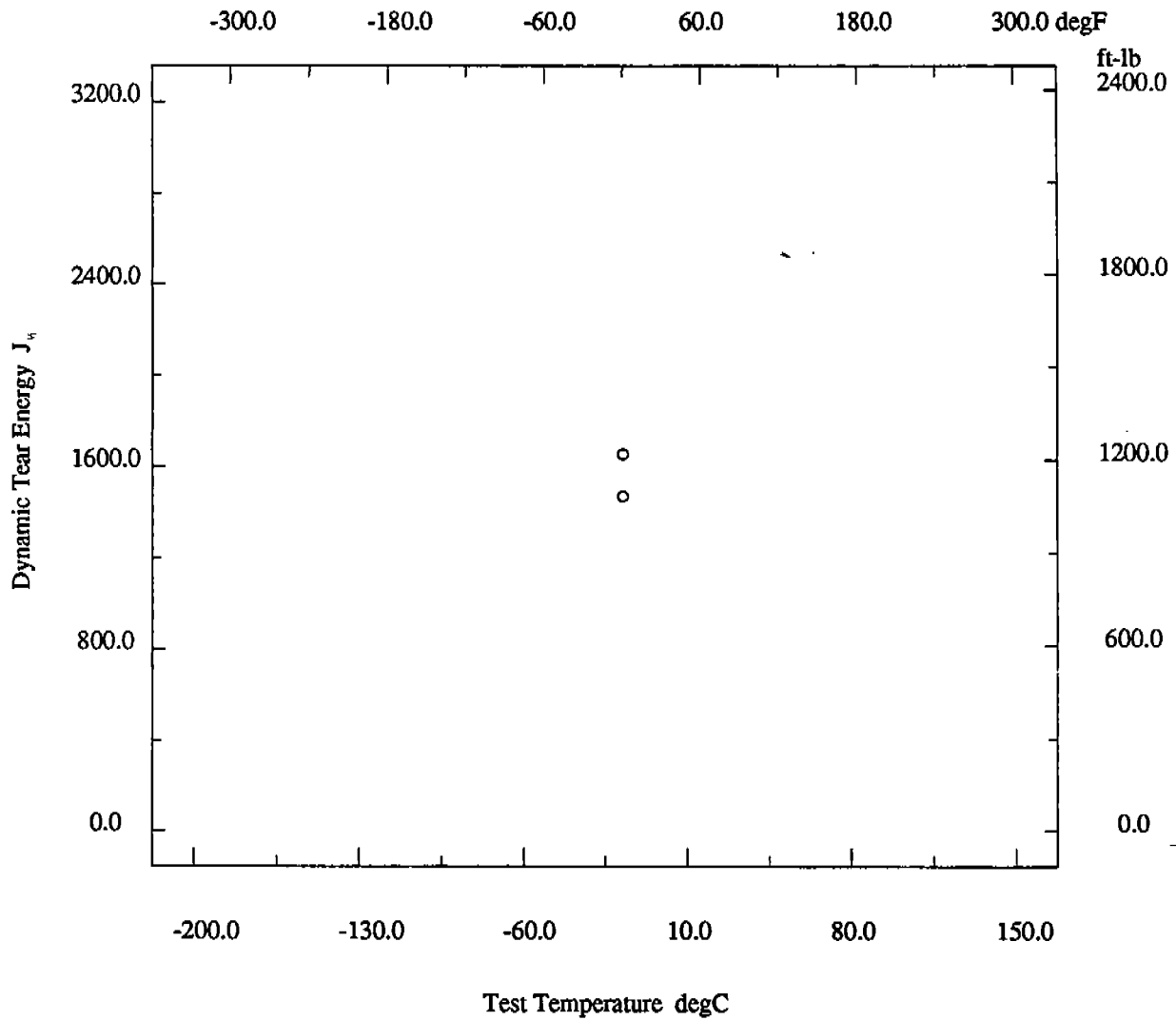
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Marine Structural Toughness Data Bank

Material HY100

Page 19600.6

Description	
Material Code	011.003.01
Material Name	HY100
UNS	*
Other Designation	*
Type	Wrought Metal
Form	Plate
Thickness	2.0 in
Composition Type	Actual
Composition Position	*
Lot ID	L467OV559
Reference	USN 6/9



* - not reported

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Marine Structural Toughness Data Bank

Material HY100

Page 19600.7

Description			
Material Code	011.003.09A	Material Name	HY100
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	2.0 in	Composition Type	Actual
Composition Position	*	Lot ID	FRO
Reference	USN 6/9		
Composition			
C	0.07 %	Mn	1.13 %
P	0.013 %	S	0.014 %
Si	*	Cr	0.15 %
Ni	3.49 %	Mo	0.45 %
V	<0.001 %	Cu	0.03 %
Cb	*	Ti	<0.01 %
B	*	Al	*
N	*	Other Components	None %
Fabrication History			
Heat Treatment	Q,T,W	Producer	*
Year Produced	*	Addl Info	None
Source	USN	Melting Practice	*
Ingot Position	*	Killing Process	*
Process Temperature	*	Process Time	*
Rolling Conditions	*	Final Processing	Q,T,W
Final Temperature	*	Final Time	*
Cold Work Strain	*	Aging Temperature	*
Aging Time	*	Location	*
Weld			
Weld Code	011.003.09A	Weld Type	SMA
Base Metal Thickness	2.0 in	Welding Position	Downhand
Preheat Temperature	*	Metal Gap	*
Interpass Temperature	*	Passes	*
Filler Specification	M22000/10	Filler Name	*
Filler Carbon Content	*	Filler Metal Size	*
Shielding Gas	*	Voltage	*
Amperage	*	Polarity	*
Travel Speed	*	Heat Input/Pass	*
Joint Preparation	*	Number of Sides	*
Location wrt Weld	11mm in HAZ	Location wrt Surface	*
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	Yes		

* - not reported

(continued)

Marine Structural Toughness Data Bank

Material HY100

Page 19600.8

(continued)

Property Measurements			
Test Type	Tensile	Position	*
Specimen Type	Cylindrical	Specimen Thickness	0.250 in
Gage Length	1.0 in	Loading Rate	0.002 in/min
Tensile Strength Offset	0.2 %	Uniform Elongation	*
Tensile Modulus	29.9 ksi*10**3	Standard Method	E 8
Standard Year	1969		

Orient	Test Temp degF	UTS ksi	TYS ksi	TYP ksi	Elongation %	RA %
L	Room	126.5	117.3	*	20	64

* - not reported



Marine Structural Toughness Data Bank

Material HY100

Page 19600.9

Description	
Material Code	011.003.09A
Material Name	HY100
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	2.0 in
Composition Type	Actual
Composition Position	*
Lot ID	FRO
Reference	USN 6/9

Composition See Page 19600.7

Fabrication History See Page 19600.7

Weld See Page 19600.7

Property Measurements	
Test Type	Fracture Toughness
Position	*
Specimen Type	Compact Tension
Specimen Thickness	1.0 in
Crack Length	*
Loading Type	I
Loading Rate	*
KQ	*
KIc	*
Valid KIc?	*
Reason for Invalid	*
KJc	*
Jlcr	Modified Standard
Initial COD	*
Curve Shape	*
Critical COD	*
Maximum J, Jmax	*
Initial JI, JI	*
Standard Method	813
Standard Year	*

Orien	Test Temp degF	Jic in-lb/in ²	Tear Mod in-lb/in ^{**2}
T-L	Room	210	25
T-L	Room	246	14
T-L	Room	302	21
T-L	Room	313	24
T-L	Room	401	8
T-L	Room	424	13
T-L	Room	438	21
T-L	Room	445	19
T-L	Room	526	13

* - not reported



Marine Structural Toughness Data Bank

Material HY100

Page 19600.10

Description	
Material Code	011.003.09A
Material Name	HY100
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	2.0 in
Composition Type	Actual
Composition Position	*
Lot ID	FRO
Reference	USN 6/9
Composition	
See Page 19600.7	
Fabrication History	
See Page 19600.7	
Weld	
See Page 19600.7	
Property Measurements	
Test Type	Charpy V Impact
Position	*
Specimen Type	Full
Lateral Expansion	*
Shear Fracture	*
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	E 23
Standard Year	1972

Orien	Test Temp degF	CVN Energy ft-lb
T-L ◦	-60	47
T-L ◦	-60	55
T-L ◦	0	56
T-L ◦	0	68

* - not reported

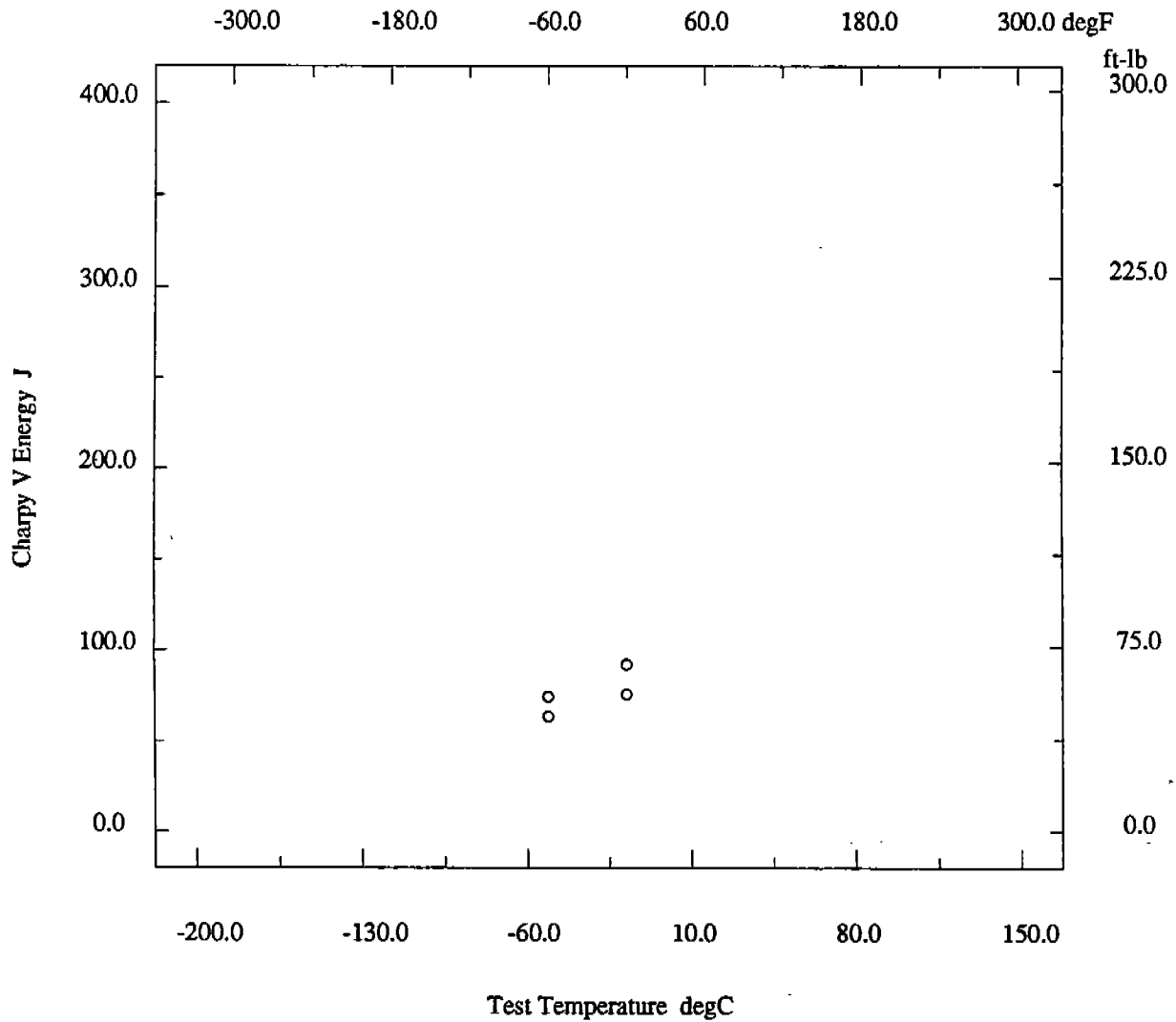
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Marine Structural Toughness Data Bank

Material HY100

Page 19600.11

Description			
Material Code	..... 011.003.09A	Material Name	..... HY100
UNS	..... *	Other Designation *
Type	..... Welded Joint	Form	..... Plate
Thickness 2.0 in	Composition Type Actual
Composition Position *	Lot ID FRO
Reference USN 6/9		



* - not reported

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Marine Structural Toughness Data Bank

Material HY100

Page 19600.12

Description			
Material Code	011.003.09A	Material Name	HY100
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	2.0 in	Composition Type	Actual
Composition Position	*	Lot ID	FRO
Reference	USN 6/9		

Composition See Page 19600.7

Fabrication History See Page 19600.7

Weld See Page 19600.7

Property Measurements			
Test Type	Dynamic Tear	Position	*
Specimen Type	Dynamic Tear	Notch Preparation	Pressed
Specimen Thickness	0.625 in	Loading Rate	*
Appearance	*	Standard Method	E 604
Standard Year	1980		

Orien	Test Temp degF	DT Energy ft-lb
T-L ◦	0	520
T-L ◦	0	580

* - not reported

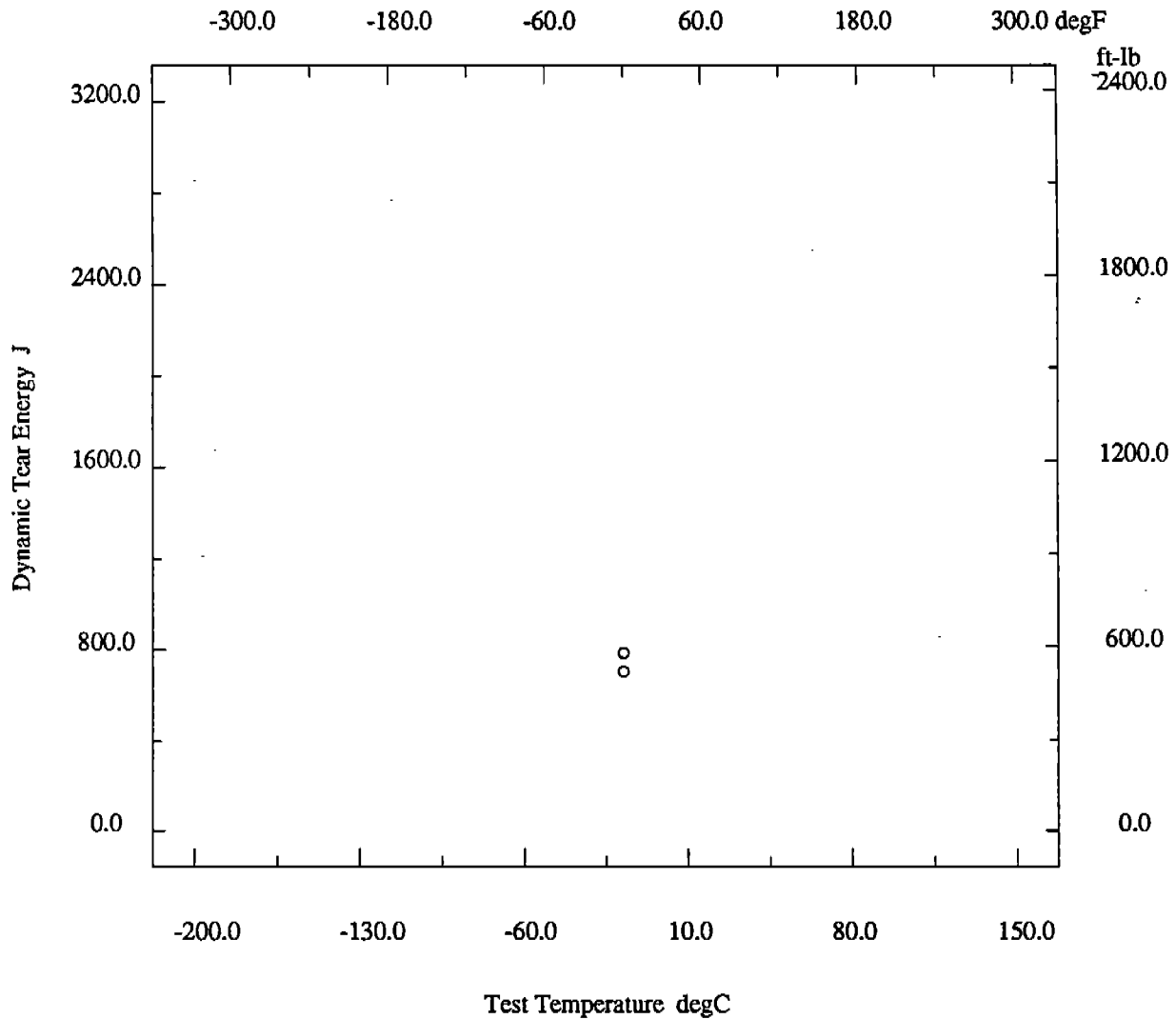


Marine Structural Toughness Data Bank

Material HY100

Page 19600.13

Description	
Material Code	011.003.09A
Material Name	HY100
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	2.0 in
Composition Type	Actual
Composition Position	*
Lot ID	FRO
Reference	USN 6/9



* - not reported



Marine Structural Toughness Data Bank

Material HY100

Page 19600.14

Description	
Material Code	011.003.09B
Material Name	HY100
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	2.0 in
Composition Type	Actual
Composition Position	*
Lot ID	FRP
Reference	USN 6/9

Composition			
C	0.07 %	Mn	1.26 %
P	0.018 %	S	0.006 %
Si	*	Cr	0.16 %
Ni	3.58 %	Mo	0.44 %
V	<0.001 %	Cu	0.04 %
Cb	*	Ti	<0.01 %
B	*	Al	*
N	*	Other Components	None %

Fabrication History See Page 19600.7

Weld			
Weld Code	011.003.09B	Weld Type	SMA
Base Metal Thickness	2.0 in	Welding Position	Downhand
Preheat Temperature	*	Metal Gap	*
Interpass Temperature	*	Passes	*
Filler Specification	M22000/10	Filler Name	*
Filler Carbon Content	*	Filler Metal Size	*
Shielding Gas	*	Voltage	*
Amperage	*	Polarity	*
Travel Speed	*	Heat Input/Pass	*
Joint Preparation	*	Number of Sides	*
Location wrt Weld	11mm in HAZ	Location wrt Surface	*
Post-Weld Heat Temp	*	Post-Weld Heat Time	*
Flux Type	*	Flux Name	*
Weld Composition Reported?	Yes		

Property Measurements			
Test Type	Tensile	Position	*
Specimen Type	Cylindrical	Specimen Thickness	0.250 in
Gage Length	1.0 in	Loading Rate	0.002 in/min
Tensile Strength Offset	0.2 %	Uniform Elongation	*
Tensile Modulus	29.5 ksi*10**3	Standard Method	E 8
Standard Year	1969		

Orient	Test Temp degF	UTS ksi	TYS ksi	TYP ksi	Elongation %	RA %
L	Room	126.0	121.0	*	16	59

* - not reported



Marine Structural Toughness Data Bank

Material HY100

Page 19600.15

Description	
Material Code	011.003.09B
Material Name	HY100
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	2.0 in
Composition Type	Actual
Composition Position	*
Lot ID	FRP
Reference	USN 6/9

Composition See Page 19600.14

Fabrication History See Page 19600.7

Weld See Page 19600.14

Property Measurements	
Test Type	Fracture Toughness
Position	*
Specimen Type	Compact Tension
Specimen Thickness	1.0 in
Crack Length	*
Loading Type	I
Loading Rate	*
KQ	*
KIc	*
Valid KIc?	*
Reason for Invalid	*
KJc	*
JIcpr	Modified Standard
Initial COD	*
Critical COD	*
Curve Shape	*
Initial JI, JI	*
Maximum J, Jmax	*
Standard Method	813
Standard Year	*

Orien	Test Temp degF	JIc in-lb/in ²	Tear Mod in-lb/in ^{**2}
T-L	Room	329	19
T-L	Room	338	27
T-L	Room	387	20
T-L	Room	416	13
T-L	Room	456	16
T-L	Room	457	16
T-L	Room	487	14
T-L	Room	494	16
T-L	Room	506	15
T-L	Room	523	15
T-L	Room	588	17

* - not reported



Marine Structural Toughness Data Bank

Material HY100

Page 19600.16

Description	
Material Code	011.003.09A
Material Name	HY100
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	2.0 in
Composition Type	Actual
Composition Position	*
Lot ID	FRP
Reference	USN 6/9
Composition	See Page 19600.14
Fabrication History	See Page 19600.7
Weld	See Page 19600.14
Property Measurements	
Test Type	Charpy V Impact
Position	*
Specimen Type	Full
Lateral Expansion	*
Shear Fracture	*
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	E 23
Standard Year	1972

Orien	Test Temp degF	CVN Energy ft-lb
T-L °	0	54

* - not reported

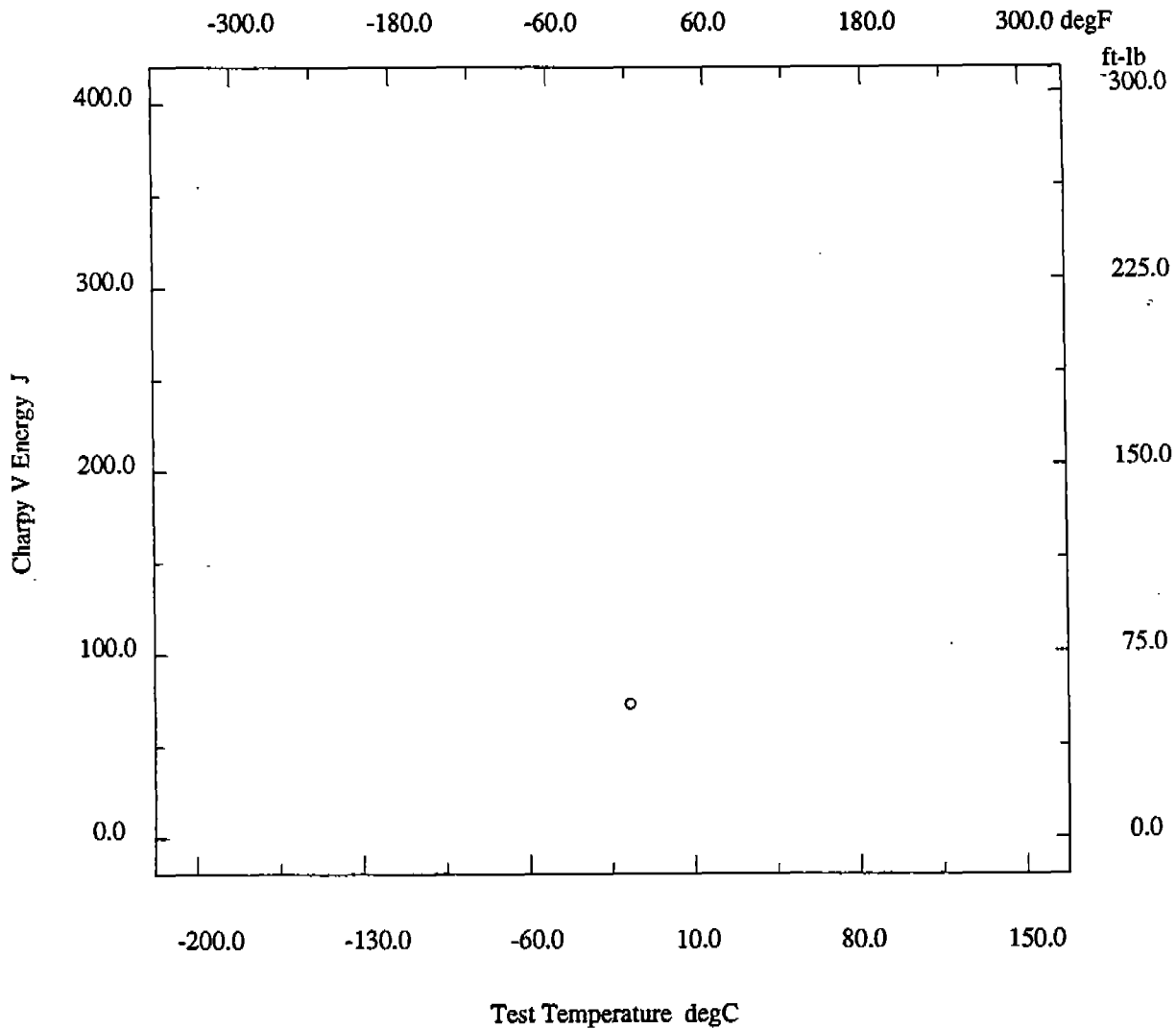
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Marine Structural Toughness Data Bank

Material HY100

Page 19600.17

Description					
Material Code	011.003.09A	Material Name	.....	HY100
UNS	*	Other Designation	.....	*
Type	Welded Joint	Form	.....	Plate
Thickness	2.0 in	Composition Type	.....	Actual
Composition Position	*	Lot ID	.....	FRP
Reference	USN 6/9			



* - not reported

Marine Structural Toughness Data Bank

Material HY100

Page 19600.18

Description	
Material Code	011.003.09B
Material Name	HY100
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	2.0 in
Composition Type	Actual
Composition Position	*
Lot ID	FRP
Reference	USN 6/9

Composition See Page 19600.14

Fabrication History See Page 19600.7

Weld See Page 19600.14

Property Measurements	
Test Type	Charpy V Impact
Position	*
Specimen Type	Full
Lateral Expansion	*
Shear Fracture	*
Did Specimen Fracture?	Assumed
Did Specimen Split?	*
Standard Method	E 23
Standard Year	1972

Orien	Test Temp degF	CVN Energy ft-lb
T-L ◦	-60	52
T-L ◦	-60	53
T-L ◦	0	55

* - not reported

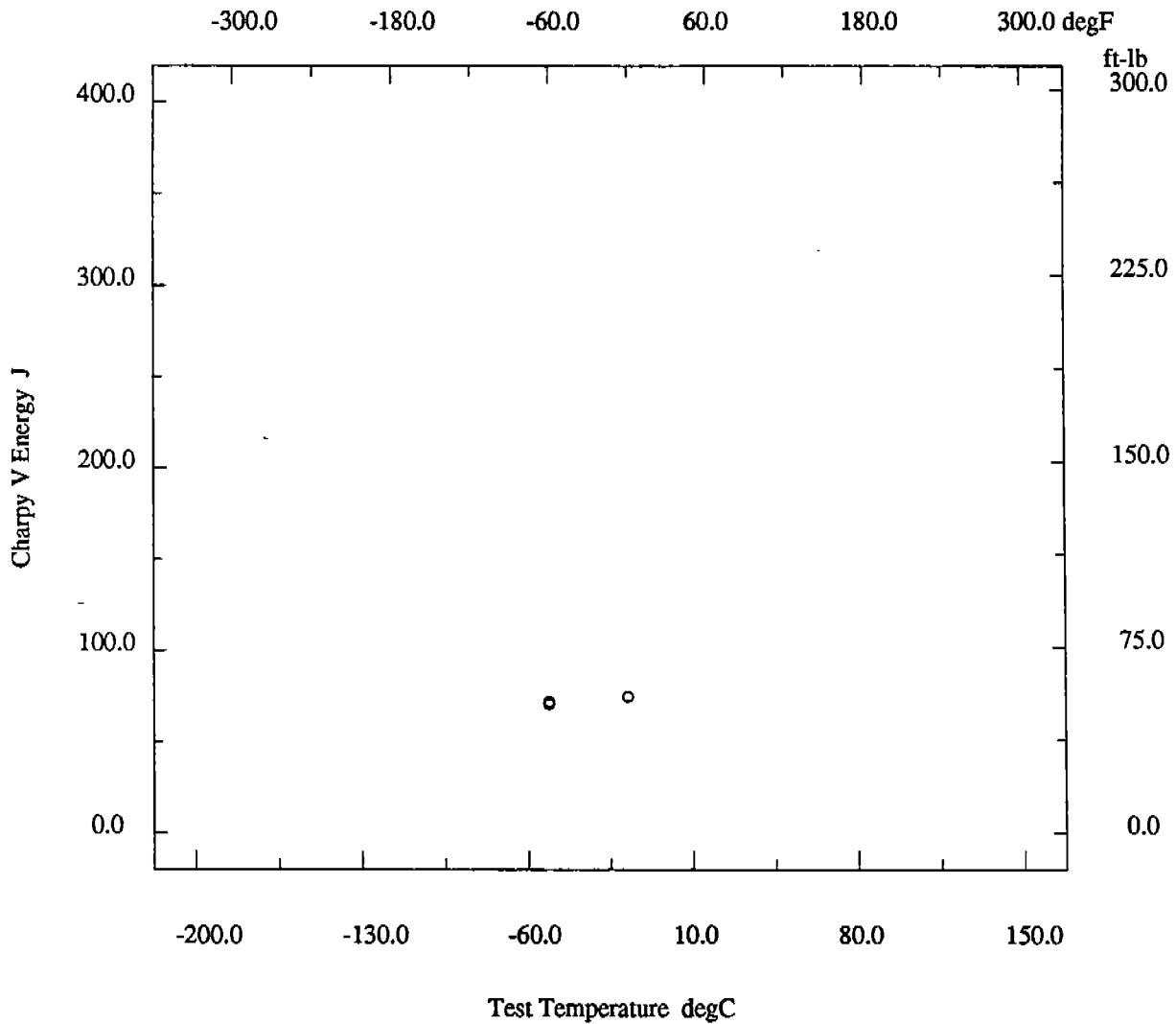
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Marine Structural Toughness Data Bank

Material HY100

Page 19600.19

Description	
Material Code	011.003.09B
Material Name	HY100
UNS	*
Other Designation	*
Type	Welded Joint
Form	Plate
Thickness	2.0 in
Composition Type	Actual
Composition Position	*
Lot ID	FRP
Reference	USN 6/9



* - not reported

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Marine Structural Toughness Data Bank

Material HY100

Page 19600.20

Description			
Material Code	011.003.09B	Material Name	HY100
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	2.0 in	Composition Type	Actual
Composition Position	*	Lot ID	FRP
Reference	USN 6/9		

Composition See Page 19600.14

Fabrication History See Page 19600.7

Weld See Page 19600.14

Property Measurements			
Test Type	Dynamic Tear	Position	*
Specimen Type	Dynamic Tear	Notch Preparation	Pressed
Specimen Thickness	0.625 in	Loading Rate	*
Appearance	*	Standard Method	E 604
Standard Year	1980		

Orien	Test Temp degF	DT Energy ft-lb
T-L ◦	0	485
T-L ◦	0	616

* - not reported

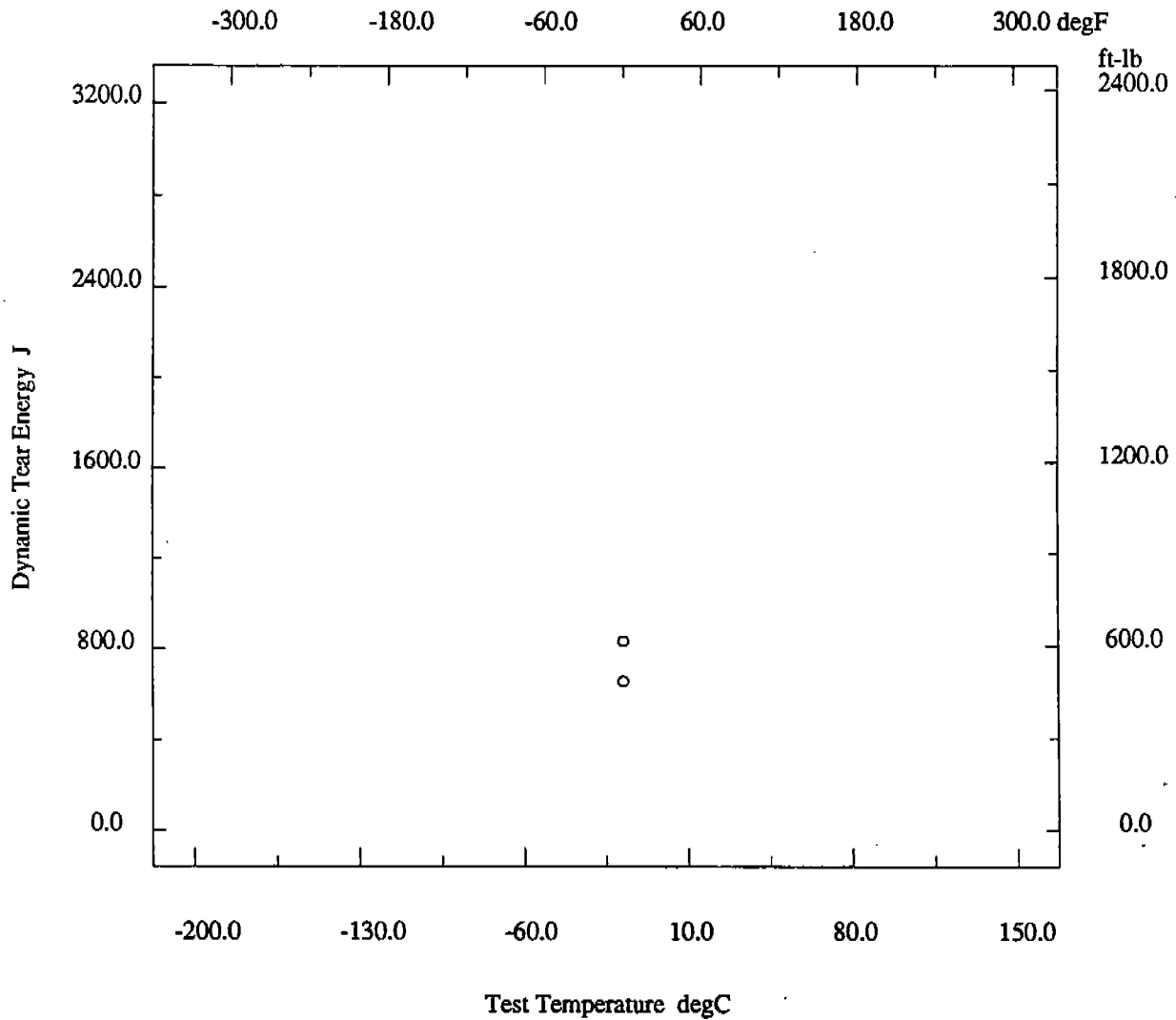
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Marine Structural Toughness Data Bank

Material HY100

Page 19600.21

Description			
Material Code	011.003.09B	Material Name	HY100
UNS	*	Other Designation	*
Type	Welded Joint	Form	Plate
Thickness	2.0 in	Composition Type	Actual
Composition Position	*	Lot ID	FRP
Reference	USN 6/9		



* - not reported

311 1/8 X

Index

0 Lot ID	3800.1-3800.4		19200.1, 19300.1, 19400.1, 19600.7, 19600.14
004-2 Reference	1100.1-1100.2, 1100.5-1100.6, 1200.1-1200.2, 1200.5-1200.6, 1300.1-1300.2, 1300.5- 1300.6, 1400.1-1400.2, 1400.5-1400.6, 1500.1-1500.2, 1500.5-1500.6, 1600.1-1600.2, 1600.5-1600.6, 1700.1- 1700.2, 1700.5-1700.6, 1800.1-1800.2, 1800.5-1800.6, 1900.1-1900.2, 1900.5-1900.6	1/2 V-Groove Joint Preparation	13800.8- 13800.36, 13900.1, 13900.4-13900.26, 14000.1- 14000.22
007-1 Reference	2100.1-2100.8, 2200.1-2200.8, 2300.1-2300.8, 2400.1-2400.20, 2500.1-2500.18, 2600.1-2600.20, 2700.1-2700.18	1211 Reference	9000.1-9000.2, 9000.5-9000.9, 9100.1- 9100.3, 9100.6-9100.9
007-4 Reference	2800.1-2800.8, 2900.1-2900.8, 3000.1-3000.8	14320 Lot ID	3600.1-3600.4
1 Lot ID	3900.1-3900.3	14453 Lot ID	4500.1-4500.4
1010 Reference	7800.1-7800.6, 7900.1-7900.6	14460 Lot ID	3300.1-3300.4
1120 Reference	16600.1-16600.7	14490 Lot ID	5700.1-5700.3
11672 Lot ID	3400.1-3400.4	14500 Lot ID	6000.1-6000.3
11682 Lot ID	4600.1-4600.3	1/4T Composition Position	13800.1-13800.37, 13900.1-13900.26, 14000.1-14000.23
11692 Lot ID	4200.1-4200.3	1/4T Location wrt Surface	7200.7-7200.8, 7200.13
11mm in HAZ Location wrt Weld	2500.16, 2700.16, 3200.1, 3200.8, 3200.12, 3200.16, 3200.20, 6400.4, 6400.10, 6400.16, 6500.1, 6600.1, 6700.1, 6800.1, 7200.7-7200.8, 7500.1, 7500.6, 7500.12, 7500.16, 7500.20, 7600.2, 7600.6, 7600.10, 7600.14, 7600.18, 7700.1, 7700.6, 7700.10, 7700.14, 7700.18, 8000.1, 8100.1, 8200.1, 8300.1, 8500.1, 8600.1, 8700.1, 8800.1, 9200.2, 9200.6, 9200.10, 9200.14, 9200.18, 9300.1, 9300.6, 9300.10, 9300.14, 9300.18, 9700.7, 9900.7, 10200.4, 10200.8, 10500.4, 10800.4, 10900.4, 11000.4, 11500.4, 12300.4, 12300.8, 12300.12, 13800.8, 13800.20, 13800.24, 13800.34, 13900.1, 13900.14, 13900.24, 14000.1, 14000.4, 14000.14, 14200.1, 14200.4-14200.6, 14200.16-14200.18, 14200.28, 14200.38-14200.40, 14300.1, 14300.4-14300.6, 14300.16- 14300.18, 14300.28, 14300.38-14300.40, 14400.1, 14400.4-14400.6, 14400.16-14400.18, 14400.28, 14400.38-14400.40, 14500.1, 14500.4-14500.6, 14500.16, 14500.26, 14500.36, 14600.1, 14600.4-14600.6, 14600.16, 14600.26, 14600.36, 14700.1-14700.3, 14700.6- 14700.8, 14700.11-14700.12, 14700.15-14700.17, 14700.20-14700.21, 14700.24-14700.26, 14800.1- 14800.3, 14800.6-14800.8, 14800.11-14800.12, 14800.15- 14800.17, 14800.20-14800.21, 14800.24-14800.26, 14900.1-14900.3, 14900.6-14900.8, 14900.11-14900.12, 14900.15-14900.17, 15000.1-15000.3, 15000.6-15000.8, 15000.11-15000.12, 15000.15-15000.17, 15000.20- 15000.21, 15000.24-15000.26, 15100.1-15100.3, 15100.6-15100.8, 15100.11-15100.12, 15100.15- 15100.17, 15100.20-15100.21, 15100.24-15100.26, 15200.1-15200.3, 15200.6-15200.8, 15200.11-15200.12, 15200.15-15200.17, 16500.1, 16500.5, 19000.1, 19100.1,	17754 Lot ID	5800.1-5800.3, 6100.1-6100.3
		17777 Lot ID	6200.1-6200.3
		17846 Lot ID	5900.1-5900.3
		18553 Lot ID	6300.1-6300.3
		1969 Standard Year	1000.14, 18600.1, 18800.1, 18900.1, 19000.2, 19100.2, 19200.2, 19300.2, 19400.2, 19600.1, 19600.8, 19600.14
		1971 Year Produced	1000.1-1000.3, 1000.6, 1000.9, 1000.12-1000.14
		1972 Standard Year	18600.3, 18700.2, 18800.3, 18900.3, 19600.3, 19600.10, 19600.16-19600.18
		1972 Year Produced	2100.1-2100.3, 2100.6, 2200.1- 2200.3, 2200.6, 2300.1-2300.3, 2400.1-2400.3, 2400.6, 2400.9, 2400.12, 2400.15, 2400.18, 2500.1, 2600.1- 2600.3, 2600.6, 2600.9, 2600.12, 2600.15, 2600.18, 2700.1, 2800.1-2800.3, 2800.6, 2900.1-2900.3, 2900.6, 3000.1-3000.3, 3000.6
		1976 Standard Year	7100.5, 7200.5, 7200.11, 7200.15
		1976 Year Produced	15300.1, 15400.1, 16000.1, 16200.1
		1977 Year Produced	16100.1, 16600.1
		1978 Year Produced	7300.1, 15500.1, 15600.1, 15900.1
		1979 Standard Year	7000.2, 14700.2, 14700.11, 14700.20, 14800.2, 14800.11, 14800.20, 14900.2, 14900.11, 15000.2, 15000.11, 15000.20, 15100.2, 15100.11, 15100.20, 15200.2, 15200.11
		1979 Year Produced	1100.1, 1200.1, 1300.1, 1400.1, 1500.1, 1600.1, 1700.1, 1800.1, 1900.1, 15700.1, 15800.1, 16300.1, 16400.1
		1980 Standard Year	18600.5, 18700.4, 18800.5, 18900.5, 19600.5, 19600.12, 19600.20
		1980 Year Produced	9000.1, 9100.1
		1981 Standard Year	16500.2-16500.6

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1981 Year Produced	17400.1, 17400.11, 17400.20	14500.22, 14500.32, 14500.42, 14600.12, 14600.22,
1982 Year Produced	12600.1, 16700.1, 16700.11,	14600.32, 14600.42
	16700.20, 16800.1, 16800.5, 16900.1, 16900.5, 17000.1,	40574 Lot ID
	17000.7, 17100.1, 17100.11, 17200.1, 17200.17,	12000.1-12000.3, 12100.1-12100.3,
	17200.32, 17300.1, 17300.11, 17500.1, 17500.11,	12200.1-12200.3
	17600.1, 17600.5, 17700.1, 17700.11, 17700.20,	41509 Lot ID
	17800.1, 17800.5, 17900.1, 17900.17, 17900.32,	10200.1-10200.11
	18000.1, 18000.7, 18100.1, 18100.7, 18200.1, 18200.11,	42252 Lot ID
	18200.20, 18300.1, 18300.17, 18300.32, 18400.1,	10800.1-10800.7, 10900.1-10900.7,
	18400.11, 18400.20, 18500.1, 18500.5, 19500.1	11000.1-11000.7
1983 Year Produced	7800.1, 7900.1	43731 Lot ID
1984 Year Produced	12500.1, 12700.1	5400.1-5400.3
1987 Standard Year	7800.2, 9000.6, 9100.2,	43752 Lot ID
	12500.2, 12600.2, 12700.2, 15700.2, 15800.2, 15900.2,	3500.1-3500.4
	16100.2	47444 Lot ID
1G Welding Position	14800.11-14800.12, 14800.15-14800.17	11200.1-11200.6
1mm in HAZ Location wrt Weld	2500.4,	47574 Lot ID
	2700.4, 6400.7, 6400.13, 6400.19-6400.21, 6500.4,	9600.1-9600.7, 9700.1-9700.10, 9800.1-9800.3
	6600.4, 6700.4, 6800.4, 7200.13, 8000.4, 8100.4,	48160 Lot ID
	8200.4, 8300.4, 8500.4, 8600.4, 8700.4, 8800.4,	9900.1-9900.10, 10000.1-10000.5,
	13800.12, 13800.28, 13900.6, 13900.18, 14000.8,	10100.1-10100.5
	14000.18, 14200.10, 14200.22, 14200.32, 14200.44,	48682 Lot ID
	14300.10, 14300.22, 14300.32, 14300.44, 14400.10,	11500.1-11500.7, 11600.1-11600.3
	14400.22, 14400.32, 14400.44, 14500.10, 14500.20,	4G Welding Position
	14500.30, 14500.40, 14600.10, 14600.20, 14600.30,	14800.1-14800.3, 14800.6-14800.8,
	14600.40	14900.11-14900.12, 14900.15-14900.17
2/3 Specimen Type	9400.2, 9600.2	50% weld, 50% HAZ Location wrt Weld
2G Welding Position	14700.11-14700.12, 14700.15-14700.17, 14800.20-14800.21, 14800.24-14800.26	13800.18, 13900.12
3200 Reference	12600.1-12600.14	50054 Lot ID
3201 Reference	15400.1-15400.6, 15700.1-15700.3,	10300.1-10300.3, 10400.1-10400.3,
	15700.6-15700.8, 15800.1-15800.3, 15800.6-15800.8,	10500.1-10500.7
	15900.1-15900.6, 16000.1-16000.6, 16100.1-16100.3,	52100 Lot ID
	16100.6-16100.8, 16200.1-16200.6, 16300.1-16300.6	12400.1-12400.3
3202 Reference	15300.1-15300.6, 15500.1-15500.2,	52110 Lot ID
	15500.5-15500.7, 15600.1-15600.6, 16400.1-16400.6	12300.1-12300.15
3/4 Specimen Type	9500.2, 9500.5, 9700.2, 9700.5-9700.9, 9800.2, 9900.2, 9900.5-9900.9, 10200.2-10200.10, 11300.2, 11400.2, 11500.2, 11600.2, 11700.2, 11700.5	52765 Lot ID
3400 Reference	12500.1-12500.6, 12700.1-12700.7	5600.1-5600.3
3530 Reference	19500.1-19500.7	52797 Lot ID
3G Welding Position	14700.20-14700.21, 14700.24-14700.26, 14900.1-14900.3, 14900.6-14900.8, 15000.20-15000.21, 15000.24-15000.26, 15100.1-15100.3, 15100.6-15100.8, 15100.20-15100.21, 15100.24-15100.26, 15200.11-15200.12, 15200.15-15200.17	5500.1-5500.3
3mm in HAZ Location wrt Weld	2500.7, 2700.7, 13800.14, 13800.30, 13900.8, 13900.20, 14000.10, 14000.20, 14200.12, 14200.24, 14200.34, 14200.46, 14300.12, 14300.24, 14300.34, 14300.46, 14400.12, 14400.24, 14400.34, 14400.46, 14500.12,	54614 Lot ID
		11100.1-11100.4
		55946 Lot ID
		11800.1-11800.6, 11900.1-11900.6
		57053 Lot ID
		11700.1-11700.6
		57221 Lot ID
		9400.1-9400.3, 9500.1-9500.6
		58568 Lot ID
		11300.1-11300.3, 11400.1-11400.3
		59609 Lot ID
		10300.4-10300.6, 10600.1-10600.4, 10700.1-10700.7
		5mm in HAZ Location wrt Weld
		2500.10, 2700.10, 13800.16, 13800.32, 13900.10, 13900.22, 14000.12, 14000.22, 14200.14, 14200.26, 14200.36, 14200.48, 14300.14, 14300.26, 14300.36, 14300.48, 14400.14, 14400.26, 14400.36, 14400.48, 14500.14, 14500.24, 14500.34, 14500.44, 14600.14, 14600.24, 14600.34, 14600.44
		60865 Lot ID
		4300.1-4300.3
		60868 Lot ID
		3700.1-3700.4, 4400.1-4400.4
		641661 Lot ID
		1100.1-1100.2, 1100.5-1100.6, 1200.1-1200.2, 1200.5-1200.6, 1300.1-1300.2, 1300.5-1300.6
		641662 Lot ID
		1400.1-1400.2, 1400.5-1400.6, 1500.1-1500.2, 1500.5-1500.6, 1600.1-1600.2, 1600.5-1600.6
		642696 Lot ID
		1800.1-1800.2, 1800.5-1800.6, 1900.1-1900.2, 1900.5-1900.6
		642697 Lot ID
		1700.1-1700.2, 1700.5-1700.6
		7mm in HAZ Location wrt Weld
		2500.13, 2700.13
		813 Standard Method
		18600.2, 18700.1, 18800.2, 18900.2, 19600.2, 19600.9, 19600.15

A

- A Lot ID** 5200.1-5200.4
A0161 Lot ID 7800.1-7800.6
A1579-2AA Lot ID 15900.1-15900.6
A36 Material Name 3100.1-3100.11, 3200.1-3200.21, 3300.1-3300.4, 3400.1-3400.4, 3500.1-3500.4, 3600.1-3600.4, 3700.1-3700.4, 3800.1-3800.4, 3900.1-3900.3, 4000.1-4000.3, 4100.1-4100.3, 4200.1-4200.3, 4300.1-4300.3, 4400.1-4400.4, 4500.1-4500.4, 4600.1-4600.3, 4700.1-4700.3, 4800.1-4800.3, 4900.1-4900.3, 5000.1-5000.4, 5100.1-5100.4, 5200.1-5200.4, 5300.1-5300.4, 5400.1-5400.3, 5500.1-5500.3, 5600.1-5600.3, 5700.1-5700.3, 5800.1-5800.3, 5900.1-5900.3, 6000.1-6000.3, 6100.1-6100.3, 6200.1-6200.3, 6300.1-6300.3, 6400.1-6400.23, 6500.1-6500.5, 6600.1-6600.5, 6700.1-6700.5, 6800.1-6800.6, 6900.1-6900.2, 7000.1-7000.2, 7000.5-7000.6
A537 CL1 Material Name 7300.1-7300.6, 7400.1-7400.11, 7500.1-7500.21
A572 Gr50 Material Name 7600.1-7600.21, 7700.1-7700.21, 7800.1-7800.6, 7900.1-7900.6
A588 GrA Material Name 9200.1-9200.21, 9300.1-9300.21
A588 Material Name 8000.1-8000.5, 8100.1-8100.5, 8200.1-8200.5, 8300.1-8300.5, 8400.1-8400.2, 8500.1-8500.5, 8600.1-8600.5, 8700.1-8700.5, 8800.1-8800.5, 8900.1-8900.2, 9000.1-9000.2, 9000.5-9000.9, 9100.1-9100.3, 9100.6-9100.9
A6175-8 Lot ID 16100.1-16100.3, 16100.6-16100.8
A6670-3A Lot ID 16400.1-16400.6
A6670-3B Lot ID 16300.1-16300.6
A710 Material Name 9400.1-9400.3, 9500.1-9500.6, 9600.1-9600.7, 9700.1-9700.10, 9800.1-9800.3, 9900.1-9900.10, 10000.1-10000.5, 10100.1-10100.5, 10200.1-10200.11, 10300.1-10300.6, 10400.1-10400.3, 10500.1-10500.7, 10600.1-10600.4, 10700.1-10700.7, 10800.1-10800.7, 10900.1-10900.7, 11000.1-11000.7, 11100.1-11100.4, 11200.1-11200.6, 11300.1-11300.3, 11400.1-11400.3, 11500.1-11500.7, 11600.1-11600.3, 11700.1-11700.6, 11800.1-11800.6, 11900.1-11900.6, 12000.1-12000.3, 12100.1-12100.3, 12200.1-12200.3, 12300.1-12300.15, 12400.1-12400.3, 12700.1-12700.7, 12800.1-12800.5, 12900.1-12900.5, 13000.1-13000.5, 13100.1-13100.5, 13200.1-13200.3, 13300.1-13300.5, 13400.1-13400.5, 13500.1-13500.5, 13600.1-13600.5, 13700.1-13700.3
A710-A Material Name 12500.1-12500.6, 12600.1-12600.14
ABS Sec43 Standard Method 2800.3, 2800.6, 2900.3, 2900.6, 3000.3, 3000.6
ABS-B Material Name 1000.1-1000.14, 1100.1-1100.2, 1100.5-1100.6, 1200.1-1200.2, 1200.5-1200.6, 1300.1-1300.2, 1300.5-1300.6, 1400.1-1400.2, 1400.5-1400.6, 1500.1-1500.2, 1500.5-1500.6, 1600.1-1600.2, 1600.5-1600.6, 1700.1-1700.2, 1700.5-1700.6, 1800.1-1800.2, 1800.5-1800.6, 1900.1-1900.2, 1900.5-1900.6
ABS-EH32 Material Name 2000.1-2000.9
ABS-EH36 Material Name 2100.1-2100.8, 2200.1-2200.8, 2300.1-2300.8, 2400.1-2400.20, 2500.1-2500.18, 2600.1-2600.20, 2700.1-2700.18, 2800.1-2800.8, 2900.1-2900.8, 3000.1-3000.8
A,F Heat Treatment 2800.2, 2800.6, 2900.1-2900.3, 2900.6, 3000.1-3000.3, 3000.6
A,F,A,F,Q,T Heat Treatment 2100.2, 2100.6, 2200.1-2200.3, 2300.1-2300.3, 2400.1-2400.3, 2400.6, 2400.9, 2400.12, 2400.15, 2400.18, 2500.1
A,F,N Heat Treatment 2800.1-2800.3
A,K Heat Treatment 12800.1, 12900.1, 13000.1, 13100.1, 13200.1, 13300.1, 13400.1, 13500.1, 13600.1, 13700.1
Al-killed Killing Process 2800.1-2800.3, 2800.6, 2900.1-2900.3, 2900.6, 3000.1-3000.3, 3000.6
A,Q,T Final Processing 16700.1, 16700.11, 16700.20, 16800.1, 16800.5, 16900.1, 16900.5, 17000.1, 17000.7, 17100.1, 17100.11, 17100.11, 17200.1, 17200.17, 17200.32, 17300.1, 17300.11, 17400.1, 17400.11, 17400.20, 17500.1, 17500.11, 17600.1, 17600.5, 17700.1, 17700.11, 17700.20, 17800.1, 17800.5, 17900.1, 17900.17, 17900.32, 18000.1, 18000.7, 18100.1, 18100.7, 18200.1, 18200.11, 18200.20, 18300.1, 18300.17, 18300.32, 18400.1, 18400.11, 18400.20, 18500.1, 18500.5
A,Q,T Heat Treatment 16700.1, 16700.11, 16700.20, 16800.1, 16800.5, 16900.1, 16900.5, 17000.1, 17000.7, 17100.1, 17100.11, 17200.1, 17200.17, 17200.32, 17300.1, 17300.11, 17400.1, 17400.11, 17400.20, 17500.1, 17500.11, 17600.1, 17600.5, 17700.1, 17700.11, 17700.20, 17800.1, 17800.5, 17900.1, 17900.17, 17900.32, 18000.1, 18000.7, 18100.1, 18100.7, 18200.1, 18200.11, 18200.20, 18300.1, 18300.17, 18300.32, 18400.1, 18400.11, 18400.20, 18500.1, 18500.5
A,R Final Processing 1000.1-1000.3, 1000.6, 1000.9, 1000.12-1000.14, 1100.1, 1200.1, 1300.1, 1400.1, 1500.1, 1600.1, 1700.1, 1800.1, 1900.1, 3100.1, 3200.1, 3300.1, 3400.1, 3500.1, 3600.1, 3700.1, 3800.1, 3900.1, 4000.1, 4100.1, 4200.1, 4300.1, 4400.1, 4500.1, 4600.1, 4700.1, 4800.1, 4900.1, 5000.1, 5100.1, 5200.1, 5300.1, 5400.1, 5500.1, 5600.1, 5700.1, 5800.1, 5900.1, 6000.1, 6100.1, 6200.1, 6300.1, 7000.1, 7600.1, 7700.1, 7800.1, 7900.1
Armco D&M Source 3700.1, 3800.1, 3900.1, 4000.1, 4100.1, 4200.1, 4300.1, 4400.1, 4500.1, 4600.1, 4700.1, 4800.1, 4900.1, 5000.1, 5100.1, 5200.1, 5300.1, 5400.1, 5500.1, 5600.1, 5700.1, 5800.1, 5900.1, 6000.1, 6100.1, 6200.1, 6300.1

- Armco Producer** 2000.1, 3300.1, 3400.1, 3500.1, 3600.1, 3700.1, 3800.1, 3900.1, 4000.1, 4100.1, 4200.1, 4300.1, 4400.1, 4500.1, 4600.1, 4700.1, 4800.1, 4900.1, 5000.1, 5100.1, 5200.1, 5300.1, 5400.1, 5500.1, 5600.1, 5700.1, 5800.1, 5900.1, 6000.1, 6100.1, 6200.1, 6300.1, 7100.1, 7200.1
- Armco Source** 2000.1, 3300.1, 3400.1, 3500.1, 3600.1
- Armco W18 Filler Name** 7200.7-7200.8, 7200.13, 10900.4-10900.6, 11500.4-11500.6
- Armco W24 Filler Name** 10200.4-10200.6, 10800.4-10800.6, 11000.4-11000.6, 12300.4-12300.6
- Armco W25 Filler Name** 9900.7-9900.9
- Armco-MPC Reference** 3300.1-3300.4, 3400.1-3400.4, 3500.1-3500.4, 3600.1-3600.4, 3700.1-3700.4, 3800.1-3800.4, 3900.1-3900.3, 4000.1-4000.3, 4100.1-4100.3, 4200.1-4200.3, 4300.1-4300.3, 4400.1-4400.4, 4500.1-4500.4, 4600.1-4600.3, 4700.1-4700.3, 4800.1-4800.3, 4900.1-4900.3, 5000.1-5000.4, 5100.1-5100.4, 5200.1-5200.4, 5300.1-5300.4, 5400.1-5400.3, 5500.1-5500.3, 5600.1-5600.3, 5700.1-5700.3, 5800.1-5800.3, 5900.1-5900.3, 6000.1-6000.3, 6100.1-6100.3, 6200.1-6200.3, 6300.1-6300.3
- Assumed Did Specimen Fracture?** 1000.3, 1000.6, 1000.9, 1000.12, 2100.3, 2100.6, 2300.3, 2300.6, 2400.3, 2400.6, 2400.9, 2400.12, 2400.15, 2400.18, 2500.2-2500.4, 2500.7, 2500.10, 2500.13, 2500.16, 2600.3, 2600.6, 2600.9, 2600.12, 2600.15, 2600.18, 2700.2-2700.4, 2700.7, 2700.10, 2700.13, 2700.16, 3100.2-3100.10, 3200.2-3200.20, 7100.2, 7300.2, 7400.2-7400.10, 7500.2-7500.20, 7600.2-7600.20, 7700.2-7700.20, 9200.2-9200.20, 9300.2-9300.20, 9400.2, 9500.2, 9500.5, 9600.2, 9600.5, 9700.2, 9700.5-9700.9, 9800.2, 9900.2, 9900.5-9900.9, 10100.2, 10200.2-10200.10, 10300.2, 10300.5, 10400.2, 10500.2-10500.6, 10600.1, 10700.2-10700.4, 10800.2-10800.6, 10900.2-10900.6, 11000.2-11000.6, 11100.1, 11200.2, 11200.5, 11300.2, 11400.2, 11500.2-11500.6, 11600.2, 11700.2, 11700.5, 11900.2, 12000.2, 12100.2, 12200.2, 12300.2-12300.14, 12400.2, 13800.8-13800.32, 13900.2-13900.22, 14000.4-14000.22, 14700.4-14700.6, 14700.9, 14700.13-14700.15, 14700.18, 14700.22-14700.24, 14700.27, 14800.4-14800.6, 14800.9, 14800.13-14800.15, 14800.18, 14800.22-14800.24, 14800.27, 14900.4-14900.6, 14900.9, 14900.13-14900.15, 14900.18, 15000.4-15000.6, 15000.9, 15000.13-15000.15, 15000.18, 15000.22-15000.24, 15000.27, 15100.4-15100.6, 15100.9, 15100.13-15100.15, 15100.18, 15100.22-15100.24, 15100.27, 15200.4-15200.6, 15200.9, 15200.13-15200.15, 15200.18, 16500.3, 16500.6, 16700.2, 16700.6, 16700.9, 16700.12, 16700.15, 16700.18, 16700.21, 16700.24, 16700.27, 16800.2, 16800.6, 16900.2, 16900.6, 17000.2, 17000.8, 17100.2, 17100.6, 17100.9, 17100.12, 17100.15, 17100.18, 17200.2, 17200.8, 17200.13, 17200.18, 17200.23, 17200.28, 17200.33, 17200.38, 17200.43, 17300.2, 17300.6, 17300.9, 17300.12, 17300.15, 17300.18, 17400.2, 17400.6, 17400.9, 17400.12, 17400.15, 17400.18, 17400.21, 17400.24, 17400.27, 17500.2, 17500.6, 17500.9, 17500.12, 17500.15, 17500.18, 17600.2, 17600.6, 17700.2, 17700.6, 17700.9, 17700.12, 17700.15, 17700.18, 17700.21, 17700.24, 17700.27, 17800.2, 17800.6, 17900.2, 17900.8, 17900.13, 17900.18, 17900.23, 17900.28, 17900.33, 17900.38, 17900.43, 18000.2, 18000.8, 18100.2, 18100.8, 18200.2, 18200.6, 18200.9, 18200.12, 18200.15, 18200.18, 18200.21, 18200.24, 18200.27, 18300.2, 18300.8, 18300.13, 18300.18, 18300.23, 18300.28, 18300.33, 18300.38, 18300.43, 18400.2, 18400.6, 18400.9, 18400.12, 18400.15, 18400.18, 18400.21, 18400.24, 18400.27, 18500.2, 18500.6, 18600.3, 18700.2, 18800.3, 18900.3, 19000.4, 19100.4, 19200.4, 19300.4, 19400.4, 19600.3, 19600.10, 19600.16-19600.18
- Australia Producer** 1100.1, 1200.1, 1300.1, 1400.1, 1500.1, 1600.1, 1700.1, 1800.1, 1900.1
- Australia Source** 1100.1, 1200.1, 1300.1, 1400.1, 1500.1, 1600.1, 1700.1, 1800.1, 1900.1
- ## B
- B Location** 1000.2, 1000.6
- B0469-2C Lot ID** 15400.1-15400.6, 16200.1-16200.6
- B1038-2B Lot ID** 18600.1-18600.6
- B-1088-3 Lot ID** 18800.1-18800.6
- B-1088-5 Lot ID** 18900.1-18900.6
- B1908-3 Lot ID** 15500.1-15500.2, 15500.5-15500.7
- B1908-5A Lot ID** 15600.1-15600.6
- B1908-5B Lot ID** 15800.1-15800.3, 15800.6-15800.8
- B5761-2R Lot ID** 19500.1-19500.7
- B8478-3 Lot ID** 17800.1-17800.7
- B8490-2 Lot ID** 17500.1-17500.19
- B8563-4 Lot ID** 17300.1-17300.19
- B8601-5 Lot ID** 17100.1-17100.19
- B8687-1 Lot ID** 17600.1-17600.7
- B8740-2 Lot ID** 17200.1-17200.46
- B8740-3 Lot ID** 16700.1-16700.28
- B8817-1 Lot ID** 18400.1-18400.28
- B9353-3 Lot ID** 16600.1-16600.7
- B9671-1E Lot ID** 12600.1-12600.14
- Back surface at root Location wrt Surface** 14200.16, 14200.38, 14300.16, 14300.38, 14400.16, 14400.38, 14500.16-14500.24, 14500.36-14500.44, 14600.16-14600.24, 14600.36-14600.44, 14700.8, 14700.17, 14700.26, 14800.8, 14800.17, 14800.26, 14900.8, 14900.17, 15000.8, 15000.17, 15000.26, 15100.8, 15100.17, 15100.26, 15200.8, 15200.17

Back surface not root Location wrt Surface

13800.20-13800.22, 14200.18-14200.26, 14200.40-
14200.48, 14300.18-14300.26, 14300.40-14300.48,
14400.18-14400.26, 14400.40-14400.48

Basic Flux Type 16500.1, 16500.5

BL55 Flux Name 13900.1, 13900.4-13900.26,
14000.4-14000.22, 14300.1-14300.48, 14400.1-14400.48,
14500.1-14500.47, 14600.1-14600.47

BOF Melting Practice 1000.1-1000.3, 1000.6,
1000.9, 1000.12-1000.14, 1100.1, 1200.1, 1300.1,
1400.1, 1500.1, 1600.1, 1700.1, 1800.1, 1900.1,
2100.1-2100.3, 2100.6, 2200.1-2200.3, 2200.6, 2300.1-
2300.3, 2400.1-2400.3, 2400.6, 2400.9, 2400.12,
2400.15, 2400.18, 2500.1, 2600.1-2600.3, 2600.6,
2600.9, 2600.12, 2600.15, 2600.18, 2700.1

Bottom Composition Position 2100.2, 2100.6-
2100.8, 2200.2, 2200.6-2200.8, 2300.2, 2400.2,
2400.6-2400.8, 2400.12-2400.14, 2400.18-2400.20,
2600.2, 2600.6-2600.8, 2600.12-2600.14, 2600.18-
2600.20, 2800.2, 2800.6-2800.8, 2900.2, 2900.6-
2900.8, 3000.2, 3000.6-3000.8

Bottom Ingot Position 2100.2, 2100.6, 2200.2,
2200.6, 2300.2, 2400.2, 2400.6, 2400.12, 2400.18,
2600.2, 2600.6, 2600.12, 2600.18, 16700.20, 16800.5,
16900.5, 17000.7, 17100.11, 17200.32, 17300.11,
17400.20, 17500.11, 17600.5, 17700.20, 17800.5,
17900.32, 18000.7, 18100.7, 18200.20, 18300.32,
18400.20, 18500.5

BS131H2 Standard Method 14700.4-14700.6,
14700.9, 14700.13-14700.15, 14700.18, 14700.22-
14700.24, 14700.27, 14800.4-14800.6, 14800.9, 14800.13-
14800.15, 14800.18, 14800.22-14800.24, 14800.27,
14900.4-14900.6, 14900.9, 14900.13-14900.15, 14900.18,
15000.4-15000.6, 15000.9, 15000.13-15000.15, 15000.18,
15000.22-15000.24, 15000.27, 15100.4-15100.6,
15100.9, 15100.13-15100.15, 15100.18, 15100.22-
15100.24, 15100.27, 15200.4-15200.6, 15200.9, 15200.13-
15200.15, 15200.18

BS4360 Gr50D Material Name 13800.1-
13800.37, 13900.1-13900.26, 14000.1-14000.23,
14100.1-14100.10, 14200.1-14200.49, 14300.1-14300.49,
14400.1-14400.49, 14500.1-14500.47, 14600.1-14600.47,
14700.1-14700.28, 14800.1-14800.28, 14900.1-14900.19,
15000.1-15000.28, 15100.1-15100.28, 15200.1-15200.19,
15300.1-15300.6, 15400.1-15400.6, 15500.1-15500.2,
15500.5-15500.7, 15600.1-15600.6, 15700.1-15700.3,
15700.6-15700.8, 15800.1-15800.3, 15800.6-15800.8,
15900.1-15900.6, 16000.1-16000.6, 16100.1-16100.3,
16100.6-16100.8, 16200.1-16200.6, 16300.1-16300.6,
16400.1-16400.6

BS5762 Standard Method 7000.2, 13800.34-
13800.37, 13900.24-13900.26, 14200.2-14200.5,
14300.2-14300.5, 14400.2-14400.5, 14500.2-14500.5,

14600.2-14600.5, 14700.2, 14700.11, 14700.20, 14800.2,
14800.11, 14800.20, 14900.2, 14900.11, 15000.2,
15000.11, 15000.20, 15100.2, 15100.11, 15100.20,
15200.2, 15200.11

Bunge Producer 16500.1

C

C Lot ID 4000.1-4000.3

C4771-39A Lot ID 18500.1-18500.7

C5830 Lot ID 16000.1-16000.6

C5830-5T Lot ID 15300.1-15300.6

C-9283-11 Lot ID 18700.1-18700.5

CG A537M Material Name 7100.1-7100.6,
7200.1-7200.16

Charpy V Impact Test Type 1000.3, 1000.6,

1000.9, 1000.12, 1100.2, 1200.2, 1300.2, 1400.2,
1500.2, 1600.2, 1700.2, 1800.2, 1900.2, 2000.4,
2100.3, 2100.6, 2200.3, 2200.6, 2300.3, 2300.6,
2400.3, 2400.6, 2400.9, 2400.12, 2400.15, 2400.18,
2500.2-2500.4, 2500.7, 2500.10, 2500.13, 2500.16,
2600.3, 2600.6, 2600.9, 2600.12, 2600.15, 2600.18,
2700.2-2700.4, 2700.7, 2700.10, 2700.13, 2700.16,
2800.3, 2800.6, 2900.3, 2900.6, 3000.3, 3000.6,
3100.2-3100.10, 3200.2-3200.20, 3300.2, 3400.2,
3500.2, 3600.2, 3700.2, 3800.2, 3900.2, 4000.2,
4100.2, 4200.2, 4300.2, 4400.2, 4500.2, 4600.2,
4700.2, 4800.2, 4900.2, 5000.2, 5100.2, 5200.2,
5300.2, 5400.2, 5500.2, 5600.2, 5700.2, 5800.2,
5900.2, 6000.2, 6100.2, 6200.2, 6300.2, 6400.1,
6400.4, 6400.7, 6400.10, 6400.13, 6400.16, 6400.19-
6400.21, 6500.2-6500.4, 6600.2-6600.4, 6700.2-
6700.4, 6800.2-6800.4, 6900.1, 7000.5, 7100.2,
7200.2, 7200.8, 7200.13, 7300.2, 7400.2-7400.10,
7500.2-7500.20, 7600.2-7600.20, 7700.2-7700.20,
7800.3, 7900.3, 8000.2-8000.4, 8100.2-8100.4, 8200.2-
8200.4, 8300.2-8300.4, 8400.1, 8500.2-8500.4, 8600.2-
8600.4, 8700.2-8700.4, 8800.2-8800.4, 8900.1, 9000.2,
9100.3, 9200.2-9200.20, 9300.2-9300.20, 9400.2,
9500.2, 9500.5, 9600.2, 9600.5, 9700.2, 9700.5-
9700.9, 9800.2, 9900.2, 9900.5-9900.9, 10000.2,
10100.2, 10200.2-10200.10, 10300.2, 10300.5, 10400.2,
10500.2-10500.6, 10600.1, 10700.2-10700.4, 10800.2-
10800.6, 10900.2-10900.6, 11000.2-11000.6, 11100.1,
11200.2, 11200.5, 11300.2, 11400.2, 11500.2-11500.6,
11600.2, 11700.2, 11700.5, 11800.2, 11800.5, 11900.2-
11900.4, 12000.2, 12100.2, 12200.2, 12300.2-12300.14,
12400.2, 12500.3, 12600.3, 12600.6, 12700.3, 12800.2,
12900.2, 13000.2, 13100.2, 13200.2, 13300.2, 13400.2,
13500.2, 13600.2, 13700.2, 13800.3-13800.5, 13800.8-
13800.32, 13900.2-13900.22, 14000.4-14000.22,
14100.5-14100.9, 14200.6-14200.48, 14300.6-14300.48,
14400.6-14400.48, 14500.6-14500.44, 14600.6-14600.44,
14700.4-14700.6, 14700.9, 14700.13-14700.15, 14700.18,

- 14700.22-14700.24, 14700.27, 14800.4-14800.6, 14800.9, 14800.13-14800.15, 14800.18, 14800.22-14800.24, 14800.27, 14900.4-14900.6, 14900.9, 14900.13-14900.15, 14900.18, 15000.4-15000.6, 15000.9, 15000.13-15000.15, 15000.18, 15000.22-15000.24, 15000.27, 15100.4-15100.6, 15100.9, 15100.13-15100.15, 15100.18, 15100.22-15100.24, 15100.27, 15200.4-15200.6, 15200.9, 15200.13-15200.15, 15200.18, 15300.2, 15400.2, 15500.2, 15600.2, 15700.3, 15800.3, 15900.3, 16000.2, 16100.3, 16200.2, 16300.2, 16400.2, 16500.3, 16500.6, 16600.2, 16700.2, 16700.6, 16700.9, 16700.12, 16700.15, 16700.18, 16700.21, 16700.24, 16700.27, 16800.2, 16800.6, 16900.2, 16900.6, 17000.2, 17000.8, 17100.2, 17100.6, 17100.9, 17100.12, 17100.15, 17100.18, 17200.2, 17200.8, 17200.13, 17200.18, 17200.23, 17200.28, 17200.33, 17200.38, 17200.43, 17300.2, 17300.6, 17300.9, 17300.12, 17300.15, 17300.18, 17400.2, 17400.6, 17400.9, 17400.12, 17400.15, 17400.18, 17400.21, 17400.24, 17400.27, 17500.2, 17500.6, 17500.9, 17500.12, 17500.15, 17500.18, 17600.2, 17600.6, 17700.2, 17700.6, 17700.9, 17700.12, 17700.15, 17700.18, 17700.21, 17700.24, 17700.27, 17800.2, 17800.6, 17900.2, 17900.8, 17900.13, 17900.18, 17900.23, 17900.28, 17900.33, 17900.38, 17900.43, 18000.2, 18000.8, 18100.2, 18100.8, 18200.2, 18200.6, 18200.9, 18200.12, 18200.15, 18200.18, 18200.21, 18200.24, 18200.27, 18300.2, 18300.8, 18300.13, 18300.18, 18300.23, 18300.28, 18300.33, 18300.38, 18300.43, 18400.2, 18400.6, 18400.9, 18400.12, 18400.15, 18400.18, 18400.21, 18400.24, 18400.27, 18500.2, 18500.6, 18600.3, 18700.2, 18800.3, 18900.3, 19000.4, 19100.4, 19200.4, 19300.4, 19400.4, 19500.5, 19600.3, 19600.10, 19600.16-19600.18
- Cleavage Curve Shape** 14800.20, 14900.11
- Compact Specimen Type** 7800.2, 9000.6, 9100.2, 12500.2, 12600.2, 12700.2, 15700.2, 15800.2, 15900.2, 16100.2
- Compact Tension Specimen Type** 18600.2, 18700.1, 18800.2, 18900.2, 19000.3, 19100.3, 19200.3, 19300.3, 19400.3, 19600.2, 19600.9, 19600.15
- Composition Position**
- 1/4T** 13800.1-13800.37, 13900.1-13900.26, 14000.1-14000.23
- Bottom** 2100.2, 2100.6-2100.8, 2200.2, 2200.6-2200.8, 2300.2, 2400.2, 2400.6-2400.8, 2400.12-2400.14, 2400.18-2400.20, 2600.2, 2600.6-2600.8, 2600.12-2600.14, 2600.18-2600.20, 2800.2, 2800.6-2800.8, 2900.2, 2900.6-2900.8, 3000.2, 3000.6-3000.8
- Ladle** 1100.1-1100.2, 1100.5-1100.6, 1200.1-1200.2, 1200.5-1200.6, 1300.1-1300.2, 1300.5-1300.6, 1400.1-1400.2, 1400.5-1400.6, 1500.1-1500.2, 1500.5-1500.6, 1600.1-1600.2, 1600.5-1600.6, 1700.1-1700.2, 1700.5-1700.6, 1800.1-1800.2, 1800.5-1800.6, 1900.1-1900.2, 1900.5-1900.6, 15500.1-15500.2, 15500.5-15500.7, 15600.1-15600.6, 16700.1-16700.28, 16800.1-16800.7, 16900.1-16900.7, 17000.1-17000.11, 17100.1-17100.19, 17200.1-17200.46, 17300.1-17300.19, 17400.1-17400.28, 17500.1-17500.19, 17600.1-17600.7, 17700.1-17700.28, 17800.1-17800.7, 17900.1-17900.46, 18000.1-18000.11, 18100.1-18100.11, 18200.1-18200.28, 18300.1-18300.46, 18400.1-18400.28, 18500.1-18500.7
- Top** 2100.1-2100.5, 2200.1-2200.5, 2300.1-2300.8, 2400.1-2400.5, 2400.9-2400.11, 2400.15-2400.17, 2500.1-2500.18, 2600.1-2600.5, 2600.9-2600.11, 2600.15-2600.17, 2700.1-2700.18, 2800.1-2800.5, 2900.1-2900.5, 3000.1-3000.5
- Concast Ingot Position** 1000.1-1000.3, 1000.6, 1000.9, 1000.12-1000.14, 1100.1, 1200.1, 1300.1, 1400.1, 1500.1, 1600.1, 1700.1, 1800.1, 1900.1, 2800.1-2800.3, 2800.6, 2900.1-2900.3, 2900.6, 3000.1-3000.3, 3000.6
- Curve Shape**
- Cleavage** 14800.20, 14900.11
- Maximum** 15000.2, 15000.20
- Cylindrical Specimen Type** 3100.1, 7000.1, 7300.1, 7400.1, 7600.1, 7800.1, 7900.1, 9000.1, 9100.1, 9200.1, 12500.1, 12600.1, 12700.1, 14700.3, 14700.8, 14700.12, 14700.17, 14700.21, 14700.26, 14800.3, 14800.8, 14800.12, 14800.17, 14800.21, 14800.26, 14900.3, 14900.8, 14900.12, 14900.17, 15000.3, 15000.8, 15000.12, 15000.17, 15000.21, 15000.26, 15100.3, 15100.8, 15100.12, 15100.17, 15100.21, 15100.26, 15200.3, 15200.8, 15200.12, 15200.17, 15300.1, 15400.1, 15500.1, 15600.1, 15700.1, 15800.1, 15900.1, 16000.1, 16100.1, 16200.1, 16300.1, 16400.1, 16500.2, 16500.5, 18600.1, 18800.1, 18900.1, 19000.2, 19100.2, 19200.2, 19300.2, 19400.2, 19600.1, 19600.8, 19600.14
- D**
- D2580-4 Lot ID** 17400.1-17400.28
- D3007-3 Lot ID** 15700.1-15700.3, 15700.6-15700.8
- D3631-7L Lot ID** 16900.1-16900.7
- D3667-3M Lot ID** 17000.1-17000.11
- D3703-4B Lot ID** 16800.1-16800.7
- D3710-42B Lot ID** 17900.1-17900.46
- D3791-2B Lot ID** 7300.1-7300.6
- D3974-1B Lot ID** 18200.1-18200.28
- D3975-3E Lot ID** 17700.1-17700.28
- D4030-4A Lot ID** 18300.1-18300.46
- D4179-3B Lot ID** 7900.1-7900.6
- D6274-4 Lot ID** 9000.1-9000.2, 9000.5-9000.9, 9100.1-9100.3, 9100.6-9100.9
- D6873-1A Lot ID** 12500.1-12500.6
- D6873-1B Lot ID** 12700.1-12700.7

Did Specimen Fracture?

Assumed 1000.3, 1000.6, 1000.9, 1000.12, 2100.3, 2100.6, 2300.3, 2300.6, 2400.3, 2400.6, 2400.9, 2400.12, 2400.15, 2400.18, 2500.2-2500.4, 2500.7, 2500.10, 2500.13, 2500.16, 2600.3, 2600.6, 2600.9, 2600.12, 2600.15, 2600.18, 2700.2-2700.4, 2700.7, 2700.10, 2700.13, 2700.16, 3100.2-3100.10, 3200.2-3200.20, 7100.2, 7300.2, 7400.2-7400.10, 7500.2-7500.20, 7600.2-7600.20, 7700.2-7700.20, 9200.2-9200.20, 9300.2-9300.20, 9400.2, 9500.2, 9500.5, 9600.2, 9600.5, 9700.2, 9700.5-9700.9, 9800.2, 9900.2, 9900.5-9900.9, 10100.2, 10200.2-10200.10, 10300.2, 10300.5, 10400.2, 10500.2-10500.6, 10600.1, 10700.2-10700.4, 10800.2-10800.6, 10900.2-10900.6, 11000.2-11000.6, 11100.1, 11200.2, 11200.5, 11300.2, 11400.2, 11500.2-11500.6, 11600.2, 11700.2, 11700.5, 11900.2, 12000.2, 12100.2, 12200.2, 12300.2-12300.14, 12400.2, 13800.8-13800.32, 13900.2-13900.22, 14000.4-14000.22, 14700.4-14700.6, 14700.9, 14700.13-14700.15, 14700.18, 14700.22-14700.24, 14700.27, 14800.4-14800.6, 14800.9, 14800.13-14800.15, 14800.18, 14800.22-14800.24, 14800.27, 14900.4-14900.6, 14900.9, 14900.13-14900.15, 14900.18, 15000.4-15000.6, 15000.9, 15000.13-15000.15, 15000.18, 15000.22-15000.24, 15000.27, 15100.4-15100.6, 15100.9, 15100.13-15100.15, 15100.18, 15100.22-15100.24, 15100.27, 15200.4-15200.6, 15200.9, 15200.13-15200.15, 15200.18, 16500.3, 16500.6, 16700.2, 16700.6, 16700.9, 16700.12, 16700.15, 16700.18, 16700.21, 16700.24, 16700.27, 16800.2, 16800.6, 16900.2, 16900.6, 17000.2, 17000.8, 17100.2, 17100.6, 17100.9, 17100.12, 17100.15, 17100.18, 17200.2, 17200.8, 17200.13, 17200.18, 17200.23, 17200.28, 17200.33, 17200.38, 17200.43, 17300.2, 17300.6, 17300.9, 17300.12, 17300.15, 17300.18, 17400.2, 17400.6, 17400.9, 17400.12, 17400.15, 17400.18, 17400.21, 17400.24, 17400.27, 17500.2, 17500.6, 17500.9, 17500.12, 17500.15, 17500.18, 17600.2, 17600.6, 17700.2, 17700.6, 17700.9, 17700.12, 17700.15, 17700.18, 17700.21, 17700.24, 17700.27, 17800.2, 17800.6, 17900.2, 17900.8, 17900.13, 17900.18, 17900.23, 17900.28, 17900.33, 17900.38, 17900.43, 18000.2, 18000.8, 18100.2, 18100.8, 18200.2, 18200.6, 18200.9, 18200.12, 18200.15, 18200.18, 18200.21, 18200.24, 18200.27, 18300.2, 18300.8, 18300.13, 18300.18, 18300.23, 18300.28, 18300.33, 18300.38, 18300.43, 18400.2, 18400.6, 18400.9, 18400.12, 18400.15, 18400.18, 18400.21, 18400.24, 18400.27, 18500.2, 18500.6, 18600.3, 18700.2, 18800.3, 18900.3, 19000.4, 19100.4, 19200.4, 19300.4, 19400.4, 19600.3, 19600.10, 19600.16-19600.18

Yes 1100.2, 1200.2, 1300.2, 1400.2, 1500.2, 1600.2, 1700.2, 1800.2, 1900.2, 2000.4, 2200.6, 2900.3,

2900.6, 3300.2, 3400.2, 3500.2, 3600.2, 3700.2, 3800.2, 3900.2, 4000.2, 4100.2, 4200.2, 4300.2, 4400.2, 4500.2, 4600.2, 4700.2, 4800.2, 4900.2, 5000.2, 5100.2, 5200.2, 5300.2, 5400.2, 5500.2, 5600.2, 5700.2, 5800.2, 5900.2, 6000.2, 6100.2, 6200.2, 6300.2, 6400.1, 6400.4, 6400.7, 6400.10, 6400.13, 6400.16, 6400.19-6400.21, 6500.2-6500.4, 6600.2-6600.4, 6700.2-6700.4, 6800.2-6800.4, 6900.1, 8000.2-8000.4, 8100.2-8100.4, 8200.2-8200.4, 8300.2-8300.4, 8400.1, 8500.2-8500.4, 8600.2-8600.4, 8700.2-8700.4, 8800.2-8800.4, 8900.1, 14100.5-14100.9

Did Specimen Split?

No 8000.2-8000.4, 8100.2-8100.4, 8200.2-8200.4, 8300.2-8300.4, 8400.1, 8500.2-8500.4, 8600.2-8600.4, 8700.2-8700.4, 8800.2-8800.4, 8900.1

DO733-1D Lot ID 18000.1-18000.11

Double Notch Bend Specimen Type 2000.3, 7000.2, 14700.2, 14700.11, 14700.20, 14800.2, 14800.11, 14800.20, 14900.2, 14900.11, 15000.2, 15000.11, 15000.20, 15100.2, 15100.11, 15100.20, 15200.2, 15200.11

Double U-Groove Joint Preparation 10800.4-10800.6, 10900.4-10900.6, 11000.4-11000.6, 12300.4-12300.6

Double V-Groove Joint Preparation 7200.7-7200.8, 7200.13, 10500.4-10500.6, 11500.4-11500.6, 12300.8-12300.14, 14500.1-14500.47, 14600.1-14600.47, 16500.1, 16500.5

Downhand IG Welding Position 2500.1, 2500.4, 2500.7, 2500.10, 2500.13, 2500.16, 2700.1, 2700.4, 2700.7, 2700.10, 2700.13, 2700.16, 3100.2-3100.10, 3200.1, 3200.4-3200.20, 7400.2-7400.10, 7500.1, 7500.4-7500.20, 14200.1-14200.48, 14300.1-14300.48, 14400.1-14400.48, 14500.1-14500.47, 14600.1-14600.47

Downhand Welding Position 7200.7-7200.8, 7200.13, 13800.8-13800.36, 13900.1, 13900.4-13900.26, 14000.1-14000.22, 16500.1, 16500.5, 19000.1, 19100.1, 19200.1, 19300.1, 19400.1, 19600.7, 19600.14

DTNSRDC Producer 19000.1, 19100.1, 19200.1

Dynamic Tear Specimen Type 2000.8, 7100.5, 7200.5, 7200.11, 7200.15, 7300.5, 7800.5, 7900.5, 9000.7, 9100.7, 12500.5, 12600.9-12600.13, 12700.6, 12800.4, 12900.4, 13000.4, 13100.4, 13300.4, 13400.4, 13500.4, 13600.4, 15300.5, 15400.5, 15500.6, 15600.5, 15700.7, 15800.7, 15900.5, 16000.5, 16100.7, 16200.5, 16300.5, 16400.5, 16600.6, 17000.5, 17000.10, 17200.5, 17200.10, 17200.15, 17200.20, 17200.25, 17200.30, 17200.35, 17200.40, 17200.45, 17900.5, 17900.10, 17900.15, 17900.20, 17900.25, 17900.30, 17900.35, 17900.40, 17900.45, 18000.5, 18000.10, 18100.5, 18100.10, 18300.5, 18300.10, 18300.15, 18300.20, 18300.25, 18300.30, 18300.35, 18300.40, 18300.45,

- 18600.5, 18700.4, 18800.5, 18900.5, 19000.6, 19100.6,
19200.6, 19300.6, 19400.6, 19500.2, 19600.5, 19600.12,
19600.20
- Dynamic Tear Test Type** 2000.8, 7100.5, 7200.5,
7200.11, 7200.15, 7300.5, 7800.5, 7900.5, 9000.7,
9100.7, 12500.5, 12600.9-12600.13, 12700.6, 12800.4,
12900.4, 13000.4, 13100.4, 13300.4, 13400.4, 13500.4,
13600.4, 15300.5, 15400.5, 15500.6, 15600.5, 15700.7,
15800.7, 15900.5, 16000.5, 16100.7, 16200.5, 16300.5,
16400.5, 16600.6, 17000.5, 17000.10, 17200.5, 17200.10,
17200.15, 17200.20, 17200.25, 17200.30, 17200.35,
17200.40, 17200.45, 17900.5, 17900.10, 17900.15,
17900.20, 17900.25, 17900.30, 17900.35, 17900.40,
17900.45, 18000.5, 18000.10, 18100.5, 18100.10,
18300.5, 18300.10, 18300.15, 18300.20, 18300.25,
18300.30, 18300.35, 18300.40, 18300.45, 18600.5,
18700.4, 18800.5, 18900.5, 19000.6, 19100.6, 19200.6,
19300.6, 19400.6, 19500.2, 19600.5, 19600.12, 19600.20
- E**
- E 208 Standard Method** 1000.14, 1100.6, 1200.6,
1300.6, 1400.6, 1500.6, 1600.6, 1700.6, 1800.6,
1900.6, 2000.7, 3300.1, 3400.1, 3500.1, 3600.1,
3700.1, 3800.1, 3900.1, 4000.1, 4100.1, 4200.1,
4300.1, 4400.1, 4500.1, 4600.1, 4700.1, 4800.1,
4900.1, 5000.1, 5100.1, 5200.1, 5300.1, 5400.1,
5500.1, 5600.1, 5700.1, 5800.1, 5900.1, 6000.1,
6100.1, 6200.1, 6300.1, 7100.4, 7200.4, 7200.10,
13800.7
- E 23 Standard Method** 7100.2, 16500.3, 16500.6,
18600.3, 18700.2, 18800.3, 18900.3, 19000.4, 19100.4,
19200.4, 19300.4, 19400.4, 19600.3, 19600.10, 19600.16-
19600.18
- E 604 Standard Method** 2000.8, 7100.5, 7200.5,
7200.11, 7200.15, 18600.5, 18700.4, 18800.5, 18900.5,
19000.6, 19100.6, 19200.6, 19300.6, 19400.6, 19600.5,
19600.12, 19600.20
- E 8 Standard Method** 7100.1, 7200.1, 7200.7,
16500.2, 16500.5, 18600.1, 18800.1, 18900.1, 19000.2,
19100.2, 19200.2, 19300.2, 19400.2, 19600.1, 19600.8,
19600.14
- E Lot ID** 5300.1-5300.4
- E10018 Filler Specification** 16500.1, 16500.5
- E11018-M Filler Specification** 9900.7-9900.9,
10200.8-10200.10
- E22000/1E Filler Name** 19100.1, 19200.1, 19300.1,
19400.1
- E318 Standard Method** 12600.2
- E7018 Filler Specification** 3100.2-3100.10, 7600.2-
7600.20
- E70-EA2 Filler Specification** 7700.1, 7700.4-
7700.20
- E72-EW-W Filler Specification** 9300.1, 9300.4-
9300.20
- E8018 Filler Specification** 10500.4-10500.6
- E8018-C1 Filler Specification** 12300.8-12300.14
- E8018C-2 Filler Specification** 9200.2-9200.20,
9700.7-9700.9
- E8018-C3 Filler Specification** 7400.2-7400.10
- E813 Standard Method** 7800.2, 7900.2, 9000.6,
9100.2, 12500.2, 12700.2, 15700.2, 15800.2, 15900.2,
16100.2, 19000.3, 19100.3, 19200.3, 19300.3, 19400.3
- EF2-F2 Filler Specification** 7500.1, 7500.4-
7500.20
- electric furnace Melting Practice** 5400.1,
5500.1, 5600.1
- ESW Weld Type** 6400.4, 6400.7, 6500.1, 6500.4,
8000.1, 8000.4, 8600.1, 8600.4
- F**
- F Heat Treatment** 1000.1-1000.3, 1000.6, 1000.9,
1000.12-1000.14, 7800.1, 7900.1
- F72-EM12K Filler Specification** 3200.1, 3200.4-
3200.20
- F96 Flux Type** 7500.1, 7500.4-7500.20
- FCA Weld Type** 14700.1-14700.3, 14700.6-14700.8,
14700.11-14700.12, 14700.15-14700.17, 14700.20-
14700.21, 14700.24-14700.26, 14800.1-14800.3,
14800.6-14800.8, 14800.11-14800.12, 14800.15-
14800.17, 14800.20-14800.21, 14800.24-14800.26,
14900.1-14900.3, 14900.6-14900.8, 14900.11-14900.12,
14900.15-14900.17, 15000.1-15000.3, 15000.6-15000.8,
15000.11-15000.12, 15000.15-15000.17, 15000.20-
15000.21, 15000.24-15000.26, 15100.1-15100.3,
15100.6-15100.8, 15100.11-15100.12, 15100.15-
15100.17, 15100.20-15100.21, 15100.24-15100.26,
15200.1-15200.3, 15200.6-15200.8, 15200.11-15200.12,
15200.15-15200.17
- Filler Alloy**
- Hardex-N** 1100.6, 1200.6, 1300.6, 1400.6, 1500.6,
1600.6, 1700.6, 1800.6, 1900.6, 7100.4, 7200.4,
7200.10
- Filler Name**
- Armco W18** 7200.7-7200.8, 7200.13, 10900.4-
10900.6, 11500.4-11500.6
- Armco W24** 10200.4-10200.6, 10800.4-10800.6,
11000.4-11000.6, 12300.4-12300.6
- Armco W25** 9900.7-9900.9
- E22000/1E** 19100.1, 19200.1, 19300.1, 19400.1
- Hobart25P** 6400.4, 6400.7, 6400.10, 6400.13,
6500.1, 6500.4, 6600.1, 6600.4
- L-50N** 13800.8-13800.36, 14200.1-14200.48
- LindeWS** 8000.1, 8000.4, 8100.1, 8100.4, 8200.1,
8200.4, 8600.1, 8600.4, 8700.1, 8700.4
- Nk203NiC** 14700.1-14700.3, 14700.6-14700.8,
14700.11-14700.12, 14700.15-14700.17, 14700.20-

14700.21, 14700.24-14700.26, 14800.1-14800.3,
14800.6-14800.8, 14800.11-14800.12, 14800.15-
14800.17, 14800.20-14800.21, 14800.24-14800.26,
14900.1-14900.3, 14900.6-14900.8, 14900.11-14900.12,
14900.15-14900.17, 15000.1-15000.3, 15000.6-15000.8,
15000.11-15000.12, 15000.15-15000.17, 15000.20-
15000.21, 15000.24-15000.26, 15100.1-15100.3,
15100.6-15100.8, 15100.11-15100.12, 15100.15-
15100.17, 15100.20-15100.21, 15100.24-15100.26,
15200.1-15200.3, 15200.6-15200.8, 15200.11-15200.12,
15200.15-15200.17

TW8544 6400.16, 6400.19-6400.21, 6700.1, 6700.4,
6800.1, 6800.4, 8300.1, 8300.4, 8500.1, 8500.4,
8800.1, 8800.4

W36 13900.1, 13900.4-13900.26, 14000.1-14000.22,
14300.1-14300.48, 14400.1-14400.48, 14500.1-14500.47,
14600.1-14600.47

Filler Specification

E10018 16500.1, 16500.5
E11018-M 9900.7-9900.9, 10200.8-10200.10
E7018 3100.2-3100.10, 7600.2-7600.20
E70-EA2 7700.1, 7700.4-7700.20
E72-EW-W 9300.1, 9300.4-9300.20
E8018 10500.4-10500.6
E8018-C1 12300.8-12300.14
E8018C-2 9200.2-9200.20, 9700.7-9700.9
E8018-C3 7400.2-7400.10
EF2-F2 7500.1, 7500.4-7500.20
F72-EM12K 3200.1, 3200.4-3200.20
M22000/10 19600.7, 19600.14
M22000/1E 19000.1
PFH-60A 2500.1, 2500.4, 2500.7, 2500.10, 2500.13,
2500.16, 2700.1, 2700.4, 2700.7, 2700.10, 2700.13,
2700.16

Final Processing

A,Q,T 16700.1, 16700.11, 16700.20, 16800.1,
16800.5, 16900.1, 16900.5, 17000.1, 17000.7, 17100.1,
17100.11, 17200.1, 17200.17, 17200.32, 17300.1,
17300.11, 17400.1, 17400.11, 17400.20, 17500.1,
17500.11, 17600.1, 17600.5, 17700.1, 17700.11,
17700.20, 17800.1, 17800.5, 17900.1, 17900.17,
17900.32, 18000.1, 18000.7, 18100.1, 18100.7, 18200.1,
18200.11, 18200.20, 18300.1, 18300.17, 18300.32,
18400.1, 18400.11, 18400.20, 18500.1, 18500.5
A,R 1000.1-1000.3, 1000.6, 1000.9, 1000.12-
1000.14, 1100.1, 1200.1, 1300.1, 1400.1, 1500.1,
1600.1, 1700.1, 1800.1, 1900.1, 3100.1, 3200.1,
3300.1, 3400.1, 3500.1, 3600.1, 3700.1, 3800.1,
3900.1, 4000.1, 4100.1, 4200.1, 4300.1, 4400.1,
4500.1, 4600.1, 4700.1, 4800.1, 4900.1, 5000.1,
5100.1, 5200.1, 5300.1, 5400.1, 5500.1, 5600.1,
5700.1, 5800.1, 5900.1, 6000.1, 6100.1, 6200.1,
6300.1, 7000.1, 7600.1, 7700.1, 7800.1, 7900.1

H 14700.1, 14800.1, 14900.1, 15000.1, 15100.1,
15200.1

K 9400.1, 9500.1, 9500.4, 9600.1, 9700.1, 9700.4,
9800.1, 9900.1, 9900.4, 9900.7, 10000.1, 10100.1,
10200.1, 10300.1, 10300.4, 10400.1, 10500.1, 10600.1,
10700.1, 10700.4, 10800.1, 10900.1, 11000.1, 11100.1,
11200.1, 11200.4, 11300.1, 11400.1, 11500.1, 11600.1,
11700.1, 11800.1, 11800.5, 11900.1, 11900.4, 12000.1,
12100.1, 12200.1, 12300.1, 12400.1

N 2000.1, 2800.1-2800.3, 2800.6, 2900.1-2900.3,
2900.6, 3000.1-3000.3, 3000.6, 7300.1, 7400.1,
7500.1, 9000.1, 9100.1, 9200.1, 9300.1, 13800.2,
13800.5, 13900.1, 14000.4, 14100.1, 14200.1, 14300.1,
14400.1, 14500.1, 14600.1, 15300.1, 15400.1, 15700.1,
15800.1, 15900.1, 16000.1, 16100.1, 16200.1, 16300.1

N,A 13800.1-13800.3, 14100.4-14100.5

N,C,A 14100.7-14100.9

Q,K 12500.1, 12700.1

Q,T 2100.1-2100.3, 2100.6, 2200.1-2200.3, 2200.6,
2300.1-2300.3, 2400.1-2400.3, 2400.6, 2400.9, 2400.12,
2400.15, 2400.18, 2500.1, 2600.1-2600.3, 2600.6,
2600.9, 2600.12; 2600.15, 2600.18, 2700.1, 7100.1,
7200.1; 12600.1, 16400.1, 18600.1, 18700.1, 18800.1,
18900.1, 19500.1, 19600.1

Q,T,W 19600.7

W 19000.1, 19100.1, 19200.1, 19300.1, 19400.1

Final surface Location wrt Surface 11500.4-
11500.6, 12300.4-12300.14, 13800.8-13800.18, 13800.24-
13800.32, 13900.1, 13900.4-13900.22, 14000.4-
14000.22, 14200.6-14200.14, 14200.28-14200.36,
14300.6-14300.14, 14300.28-14300.36, 14400.6-
14400.14, 14400.28-14400.36, 14500.6-14500.14,
14500.26-14500.34, 14600.6-14600.14, 14600.26-
14600.34, 14700.3, 14700.12, 14700.21, 14800.3,
14800.12, 14800.21, 14900.3, 14900.12, 15000.3,
15000.12, 15000.21, 15100.3, 15100.12, 15100.21,
15200.3, 15200.12

Flat Specimen Type 13800.1-13800.2

Flat Welding Position 9700.7-9700.9, 9900.7-
9900.9, 10200.4-10200.10, 10800.4-10800.6, 10900.4-
10900.6, 11000.4-11000.6, 11500.4-11500.6, 12300.4-
12300.6

Flux Name

BL55 13900.1, 13900.4-13900.26, 14000.4-14000.22,
14300.1-14300.48, 14400.1-14400.48, 14500.1-14500.47,
14600.1-14600.47

Hobart201 6400.4, 6400.7, 6400.10, 6400.13,
6400.16, 6400.19-6400.21, 6500.1, 6500.4, 6600.1,
6600.4, 6700.1, 6700.4, 6800.1, 6800.4, 8000.1,
8000.4, 8100.1, 8100.4, 8200.1, 8200.4, 8300.1,
8300.4, 8500.1, 8500.4, 8600.1, 8600.4, 8700.1,
8700.4, 8800.1, 8800.4

Linc 860 7200.7-7200.8, 7200.13

727

- Linc 880** 11500.4-11500.6
Linc 882 10900.4-10900.6
Linde166p 10200.4-10200.6, 10800.4-10800.6,
 11000.4-11000.6, 12300.4-12300.6
Linde709-5 9900.7-9900.9
US-43 2500.1, 2500.4, 2500.7, 2500.10, 2500.13,
 2500.16, 2700.1, 2700.4, 2700.7, 2700.10, 2700.13,
 2700.16
- Flux Type**
Basic 16500.1, 16500.5
F96 7500.1, 7500.4-7500.20
- Fracture Toughness Test Type** 2000.3, 7000.2,
 7800.2, 7900.2, 9000.6, 9100.2, 12500.2, 12600.2,
 12700.2, 13800.34-13800.37, 13900.24-13900.26,
 14000.2-14000.3, 14100.3, 14200.2-14200.5, 14300.2-
 14300.5, 14400.2-14400.5, 14500.2-14500.5, 14600.2-
 14600.5, 14700.2, 14700.11, 14700.20, 14800.2,
 14800.11, 14800.20, 14900.2, 14900.11, 15000.2,
 15000.11, 15000.20, 15100.2, 15100.11, 15100.20,
 15200.2, 15200.11, 15700.2, 15800.2, 15900.2, 16100.2,
 16600.1, 18600.2, 18700.1, 18800.2, 18900.2, 19000.3,
 19100.3, 19200.3, 19300.3, 19400.3, 19600.2, 19600.9,
 19600.15
- FRM Lot ID** 19000.1-19000.7
FRN Lot ID 19100.1-19100.7
FRO Lot ID 19600.7-19600.13
FRP Lot ID 19600.14-19600.21
- Full cross section Location wrt Surface** 13800.34-
 13800.36, 13900.24-13900.26, 14000.1-14000.3,
 14200.1-14200.5, 14300.1-14300.5, 14400.1-14400.5,
 14500.1-14500.5, 14600.1-14600.5, 14600.46-14600.47
- Full Specimen Type** 1100.2, 1200.2, 1300.2,
 1400.2, 1500.2, 1600.2, 1700.2, 1800.2, 1900.2,
 2000.4, 2100.1-2100.3, 2100.6, 2200.1-2200.3, 2200.6,
 2300.1-2300.3, 2300.6, 2400.1-2400.3, 2400.6, 2400.9,
 2400.12, 2400.15, 2400.18, 2500.2-2500.4, 2500.7,
 2500.10, 2500.13, 2500.16, 2600.1-2600.3, 2600.6,
 2600.9, 2600.12, 2600.15, 2600.18, 2700.2-2700.4,
 2700.7, 2700.10, 2700.13, 2700.16, 2800.3, 2800.6,
 2900.3, 2900.6, 3000.3, 3000.6, 3100.2-3100.10,
 3200.2-3200.20, 3700.2, 3800.2, 3900.2, 4000.2,
 4100.2, 4200.2, 4300.2, 4400.2, 4500.2, 4600.2,
 4700.2, 4800.2, 4900.2, 5000.2, 5100.2, 5200.2,
 5300.2, 5400.2, 5500.2, 5600.2, 5700.2, 5800.2,
 5900.2, 6000.2, 6100.2, 6200.2, 6300.2, 6400.1,
 6400.4, 6400.7, 6400.10, 6400.13, 6400.16, 6400.19-
 6400.21, 6500.2-6500.4, 6600.2-6600.4, 6700.2-
 6700.4, 6800.2-6800.4, 6900.1, 7000.5, 7100.2,
 7200.2, 7200.8, 7200.13, 7300.2, 7400.2-7400.10,
 7500.2-7500.20, 7600.2-7600.20, 7700.2-7700.20,
 7800.3, 7900.3, 8000.2-8000.4, 8100.2-8100.4, 8200.2-
 8200.4, 8300.2-8300.4, 8400.1, 8500.2-8500.4, 8600.2-
 8600.4, 8700.2-8700.4, 8800.2-8800.4, 8900.1, 9000.2,
 9100.3, 9200.2-9200.20, 9300.2-9300.20, 10100.2,
 10300.2, 10300.5, 10400.2, 10500.2-10500.6, 10600.1,
 10700.2-10700.4, 10800.2-10800.6, 10900.2-10900.6,
 11000.2-11000.6, 11100.1, 11200.2, 11200.5, 11500.4-
 11500.6, 11800.2, 11800.5, 11900.2-11900.4, 12000.2,
 12100.2, 12200.2, 12300.2-12300.14, 12400.2, 12500.3,
 12600.3, 12600.6, 12700.3, 12800.2, 12900.2, 13000.2,
 13100.2, 13200.2, 13300.2, 13400.2, 13500.2, 13600.2,
 13700.2, 13800.8-13800.32, 13900.2-13900.22, 14100.5-
 14100.9, 14700.4-14700.6, 14700.9, 14700.13-14700.15,
 14700.18, 14700.22-14700.24, 14700.27, 14800.4-
 14800.6, 14800.9, 14800.13-14800.15, 14800.18,
 14800.22-14800.24, 14800.27, 14900.4-14900.6,
 14900.9, 14900.13-14900.15, 14900.18, 15000.4-
 15000.6, 15000.9, 15000.13-15000.15, 15000.18,
 15000.22-15000.24, 15000.27, 15100.4-15100.6,
 15100.9, 15100.13-15100.15, 15100.18, 15100.22-
 15100.24, 15100.27, 15200.4-15200.6, 15200.9, 15200.13-
 15200.15, 15200.18, 15300.2, 15400.2, 15500.2,
 15600.2, 15700.3, 15800.3, 15900.3, 16000.2, 16100.3,
 16200.2, 16300.2, 16400.2, 16500.3, 16500.6, 16700.2,
 16700.6, 16700.9, 16700.12, 16700.15, 16700.18,
 16700.21, 16700.24, 16700.27, 16800.2, 16800.6,
 16900.2, 16900.6, 17000.2, 17000.8, 17100.2, 17100.6,
 17100.9, 17100.12, 17100.15, 17100.18, 17200.2,
 17200.8, 17200.13, 17200.18, 17200.23, 17200.28,
 17200.33, 17200.38, 17200.43, 17300.2, 17300.6,
 17300.9, 17300.12, 17300.15, 17300.18, 17400.2,
 17400.6, 17400.9, 17400.12, 17400.15, 17400.18,
 17400.21, 17400.24, 17400.27, 17500.2, 17500.6,
 17500.9, 17500.12, 17500.15, 17500.18, 17600.2,
 17600.6, 17700.2, 17700.6, 17700.9, 17700.12, 17700.15,
 17700.18, 17700.21, 17700.24, 17700.27, 17800.2,
 17800.6, 17900.2, 17900.8, 17900.13, 17900.18,
 17900.23, 17900.28, 17900.33, 17900.38, 17900.43,
 18000.2, 18000.8, 18100.2, 18100.8, 18200.2, 18200.6,
 18200.9, 18200.12, 18200.15, 18200.18, 18200.21,
 18200.24, 18200.27, 18300.2, 18300.8, 18300.13,
 18300.18, 18300.23, 18300.28, 18300.33, 18300.38,
 18300.43, 18400.2, 18400.6, 18400.9, 18400.12,
 18400.15, 18400.18, 18400.21, 18400.24, 18400.27,
 18500.2, 18500.6, 18600.3, 18700.2, 18800.3, 18900.3,
 19000.4, 19100.4, 19200.4, 19300.4, 19400.4, 19500.5,
 19600.3, 19600.10, 19600.16-19600.18
- Fully Killing Process** 1100.1, 1200.1, 1300.1,
 1400.1, 1500.1, 1600.1, 1700.1, 1800.1, 1900.1,
 2000.1, 2100.1-2100.3, 2100.6, 2200.1-2200.3, 2200.6,
 2300.1-2300.3, 2400.1-2400.3, 2400.6, 2400.9, 2400.12,
 2400.15, 2400.18, 2500.1, 2600.1-2600.3, 2600.6,
 2600.9, 2600.12, 2600.15, 2600.18, 2700.1
- Fusion line Location wrt Weld** 2500.1, 2700.1,
 3100.2-3100.10, 3200.4-3200.6, 3200.10, 3200.14,
 3200.18, 7400.2-7400.10, 7500.4, 7500.8-7500.10,

- 7500.14, 7500.18, 7600.4, 7600.8, 7600.12, 7600.16, 7600.20, 7700.4, 7700.8, 7700.12, 7700.16, 7700.20, 9200.4, 9200.8, 9200.12, 9200.16, 9200.20, 9300.4, 9300.8, 9300.12, 9300.16, 9300.20, 9700.9, 9900.9, 10200.6, 10200.10, 10500.6, 10800.6, 10900.6, 11000.6, 11500.6, 12300.6, 12300.10, 12300.14, 13800.10, 13800.22, 13800.26, 13800.36, 13900.4, 13900.16, 13900.26, 14000.3, 14000.6, 14000.16, 14200.3-14200.5, 14200.8, 14200.20, 14200.30, 14200.42, 14300.3-14300.5, 14300.8, 14300.20, 14300.30, 14300.42, 14400.3-14400.5, 14400.8, 14400.20, 14400.30, 14400.42, 14500.3-14500.5, 14500.8, 14500.18, 14500.28, 14500.38, 14600.3-14600.5, 14600.8, 14600.18, 14600.28, 14600.38
- FVD Lot ID** 19200.1-19200.7
FXF Lot ID 19400.1-19400.7
FXG Lot ID 19300.1-19300.7
- G**
G Lot ID 4100.1-4100.3
G9011 Lot ID 2300.1-2300.8
G9837 Lot ID 2600.1-2600.20, 2700.1-2700.18
- H**
H Final Processing 14700.1, 14800.1, 14900.1, 15000.1, 15100.1, 15200.1
H Lot ID 5000.1-5000.4
Hardex-N Filler Alloy 1100.6, 1200.6, 1300.6, 1400.6, 1500.6, 1600.6, 1700.6, 1800.6, 1900.6, 7100.4, 7200.4, 7200.10
Heat Treatment
A,F 2800.2, 2800.6, 2900.1-2900.3, 2900.6, 3000.1-3000.3, 3000.6
A,F,A,F,Q,T 2100.2, 2100.6, 2200.1-2200.3, 2300.1-2300.3, 2400.1-2400.3, 2400.6, 2400.9, 2400.12, 2400.15, 2400.18, 2500.1
A,F,N 2800.1-2800.3
A,K 12800.1, 12900.1, 13000.1, 13100.1, 13200.1, 13300.1, 13400.1, 13500.1, 13600.1, 13700.1
A,Q,T 16700.1, 16700.11, 16700.20, 16800.1, 16800.5, 16900.1, 16900.5, 17000.1, 17000.7, 17100.1, 17100.11, 17200.1, 17200.17, 17200.32, 17300.1, 17300.11, 17400.1, 17400.11, 17400.20, 17500.1, 17500.11, 17600.1, 17600.5, 17700.1, 17700.11, 17700.20, 17800.1, 17800.5, 17900.1, 17900.17, 17900.32, 18000.1, 18000.7, 18100.1, 18100.7, 18200.1, 18200.11, 18200.20, 18300.1, 18300.17, 18300.32, 18400.1, 18400.11, 18400.20, 18500.1, 18500.5
F 1000.1-1000.3, 1000.6, 1000.9, 1000.12-1000.14, 7800.1, 7900.1
N 7300.1, 9000.1, 9100.1, 15700.1, 15800.1, 15900.1, 16000.1, 16100.1, 16200.1, 16300.1
Q,K 9400.1, 9500.1, 9500.4, 9600.1, 9700.1, 9700.4, 9800.1, 9900.1, 9900.4, 9900.7, 10000.1, 10100.1, 10200.1, 10300.1, 10300.4, 10400.1, 10500.1, 10600.1, 10700.1, 10700.4, 10800.1, 10900.1, 11000.1, 11100.1, 11200.1, 11200.4, 11300.1, 11400.1, 11500.1, 11600.1, 11700.1, 11800.1, 11800.5, 11900.1, 11900.4, 12000.1, 12100.1, 12200.1, 12300.1, 12400.1, 12500.1, 12700.1
Q,T 7100.1, 7200.1, 12600.1, 15300.1, 15400.1, 15500.1, 15600.1, 16400.1, 18600.1, 18700.1, 18800.1, 18900.1, 19500.1, 19600.1
Q,T,W 19600.7
W 19000.1, 19100.1, 19200.1, 19300.1, 19400.1
HIFAB Source 14700.1, 14800.1, 14900.1, 15000.1, 15100.1, 15200.1
Hobart201 Flux Name 6400.4, 6400.7, 6400.10, 6400.13, 6400.16, 6400.19-6400.21, 6500.1, 6500.4, 6600.1, 6600.4, 6700.1, 6700.4, 6800.1, 6800.4, 8000.1, 8000.4, 8100.1, 8100.4, 8200.1, 8200.4, 8300.1, 8300.4, 8500.1, 8500.4, 8600.1, 8600.4, 8700.1, 8700.4, 8800.1, 8800.4
Hobart25P Filler Name 6400.4, 6400.7, 6400.10, 6400.13, 6500.1, 6500.4, 6600.1, 6600.4
HY100 Material Name 19500.1-19500.7, 19600.1-19600.21
HY80 Material Name 16500.1-16500.7, 16600.1-16600.7, 16700.1-16700.28, 16800.1-16800.7, 16900.1-16900.7, 17000.1-17000.11, 17100.1-17100.19, 17200.1-17200.46, 17300.1-17300.19, 17400.1-17400.28, 17500.1-17500.19, 17600.1-17600.7, 17700.1-17700.28, 17800.1-17800.7, 17900.1-17900.46, 18000.1-18000.11, 18100.1-18100.11, 18200.1-18200.28, 18300.1-18300.46, 18400.1-18400.28, 18500.1-18500.7, 18600.1-18600.6, 18700.1-18700.5, 18800.1-18800.6, 18900.1-18900.6, 19000.1-19000.7, 19100.1-19100.7, 19200.1-19200.7, 19300.1-19300.7, 19400.1-19400.7
- I**
I Loading Type 18600.2, 18700.1, 18800.2, 18900.2, 19000.3, 19100.3, 19200.3, 19300.3, 19400.3, 19600.2, 19600.9, 19600.15
I Lot ID 5100.1-5100.4
IG Welding Position 7600.2-7600.20, 7700.1, 7700.4-7700.20, 9200.2-9200.20, 9300.1, 9300.4-9300.20, 14700.1-14700.3, 14700.6-14700.8, 15000.1-15000.3, 15000.6-15000.8, 15000.11-15000.12, 15000.15-15000.17, 15100.11-15100.12, 15100.15-15100.17, 15200.1-15200.3, 15200.6-15200.8
Ingot Position
Bottom 2100.2, 2100.6, 2200.2, 2200.6, 2300.2, 2400.2, 2400.6, 2400.12, 2400.18, 2600.2, 2600.6, 2600.12, 2600.18, 16700.20, 16800.5, 16900.5, 17000.7, 17100.11, 17200.32, 17300.11, 17400.20, 17500.11, 17600.5, 17700.20, 17800.5, 17900.32, 18000.7, 18100.7, 18200.20, 18300.32, 18400.20, 18500.5
Concast 1000.1-1000.3, 1000.6, 1000.9, 1000.12-1000.14, 1100.1, 1200.1, 1300.1, 1400.1, 1500.1,

1600.1, 1700.1, 1800.1, 1900.1, 2800.1-2800.3,
2800.6, 2900.1-2900.3, 2900.6, 3000.1-3000.3, 3000.6
Mid 16700.11, 17200.17, 17400.11, 17700.11,
17900.17, 18200.11, 18300.17, 18400.11
Top 2100.1-2100.3, 2200.1-2200.3, 2300.1-2300.3,
2400.1-2400.3, 2400.9, 2400.15, 2500.1, 2600.1-
2600.3, 2600.9, 2600.15, 2700.1, 16700.1, 16800.1,
16900.1, 17000.1, 17100.1, 17200.1, 17300.1, 17400.1,
17500.1, 17600.1, 17700.1, 17800.1, 17900.1, 18000.1,
18100.1, 18200.1, 18300.1, 18400.1, 18500.1

J

J131267 Lot ID 1000.1-1000.14

J1cpr

Modified Standard 18600.2, 18700.1, 18800.2,
18900.2, 19000.3, 19100.3, 19200.3, 19300.3, 19400.3,
19600.2, 19600.9, 19600.15

Per Standard 7800.2, 7900.2, 9000.6, 9100.2,
12500.2, 12600.2, 12700.2, 15700.2, 15800.2, 15900.2,
16100.2

JISZ3121 Standard Method 14600.46-14600.47

Joint Preparation

1/2 V-Groove 13800.8-13800.36, 13900.1,
13900.4-13900.26, 14000.1-14000.22

Double U-Groove 10800.4-10800.6, 10900.4-
10900.6, 11000.4-11000.6, 12300.4-12300.6

Double V-Groove 7200.7-7200.8, 7200.13,
10500.4-10500.6, 11500.4-11500.6, 12300.8-12300.14,
14500.1-14500.47, 14600.1-14600.47, 16500.1, 16500.5

K-Groove 3100.2-3100.10, 7400.2-7400.10, 7600.2-
7600.20, 9200.2-9200.20, 9300.1, 9300.4-9300.20,
14200.1-14200.48, 14300.1-14300.48, 14400.1-14400.48

No Groove 6600.1, 6600.4, 6700.1, 6700.4,
6800.1, 6800.4, 8100.1, 8100.4, 8200.1, 8200.4,
8300.1, 8300.4, 8500.1, 8500.4, 8700.1, 8700.4,
8800.1, 8800.4

Smooth Butt 6400.4, 6400.7, 6400.10, 6400.13,
6400.16, 6400.19-6400.21, 6500.1, 6500.4, 8000.1,
8000.4, 8600.1, 8600.4, 10200.4-10200.6

U Groove 2500.1, 2500.4, 2500.7, 2500.10,
2500.13, 2500.16, 2700.1, 2700.4, 2700.7, 2700.10,
2700.13, 2700.16

V Groove 3200.1, 3200.4-3200.20, 7500.1, 7500.4-
7500.20, 7700.1, 7700.4-7700.20, 9700.7-9700.9,
9900.7-9900.9, 10200.8-10200.10, 14700.1-14700.3,
14700.6-14700.8, 14700.11-14700.12, 14700.15-
14700.17, 14700.20-14700.21, 14700.24-14700.26,
14800.1-14800.3, 14800.6-14800.8, 14800.11-14800.12,
14800.15-14800.17, 14800.20-14800.21, 14800.24-
14800.26, 14900.1-14900.3, 14900.6-14900.8, 14900.11-
14900.12, 14900.15-14900.17, 15000.1-15000.3,
15000.6-15000.8, 15000.11-15000.12, 15000.15-
15000.17, 15000.20-15000.21, 15000.24-15000.26,

15100.1-15100.3, 15100.6-15100.8, 15100.11-15100.12,
15100.15-15100.17, 15100.20-15100.21, 15100.24-
15100.26, 15200.1-15200.3, 15200.6-15200.8, 15200.11-
15200.12, 15200.15-15200.17

K

K Final Processing 9400.1, 9500.1, 9500.4, 9600.1,
9700.1, 9700.4, 9800.1, 9900.1, 9900.4, 9900.7,
10000.1, 10100.1, 10200.1, 10300.1, 10300.4, 10400.1,
10500.1, 10600.1, 10700.1, 10700.4, 10800.1, 10900.1,
11000.1, 11100.1, 11200.1, 11200.4, 11300.1, 11400.1,
11500.1, 11600.1, 11700.1, 11800.1, 11800.5, 11900.1,
11900.4, 12000.1, 12100.1, 12200.1, 12300.1, 12400.1

K Killing Process 5400.1, 5500.1, 5600.1, 5700.1,
5800.1, 5900.1, 6000.1, 6100.1, 6200.1, 6300.1

K1325 Lot ID 2400.1-2400.20, 2500.1-2500.18

k21-6425 Lot ID 3000.1-3000.8

K21-7102 Lot ID 2900.1-2900.8

K22-6296 Lot ID 2800.1-2800.8

KB6479 Lot ID 2100.1-2100.8, 2200.1-2200.8

K-Groove Joint Preparation 3100.2-3100.10,
7400.2-7400.10, 7600.2-7600.20, 9200.2-9200.20,
9300.1, 9300.4-9300.20, 14200.1-14200.48, 14300.1-
14300.48, 14400.1-14400.48

Killing Process

Al-killed 2800.1-2800.3, 2800.6, 2900.1-2900.3,
2900.6, 3000.1-3000.3, 3000.6

Fully 1100.1, 1200.1, 1300.1, 1400.1, 1500.1,
1600.1, 1700.1, 1800.1, 1900.1, 2000.1, 2100.1-
2100.3, 2100.6, 2200.1-2200.3, 2200.6, 2300.1-
2300.3, 2400.1-2400.3, 2400.6, 2400.9, 2400.12,
2400.15, 2400.18, 2500.1, 2600.1-2600.3, 2600.6,
2600.9, 2600.12, 2600.15, 2600.18, 2700.1

K 5400.1, 5500.1, 5600.1, 5700.1, 5800.1, 5900.1,
6000.1, 6100.1, 6200.1, 6300.1

Si-Al 7400.1, 7500.1

Silicon 1000.1-1000.3, 1000.6, 1000.9, 1000.12-
1000.14

SK 3300.1, 3400.1, 3500.1, 3600.1, 3700.1, 3800.1,
3900.1, 4000.1, 4100.1, 4200.1, 4300.1, 4400.1,
4500.1, 4600.1, 4700.1, 4800.1, 4900.1, 5000.1,
5100.1, 5200.1, 5300.1

Kobe Producer 2100.1-2100.3, 2100.6, 2200.1-
2200.3, 2200.6, 2300.1-2300.3, 2400.1-2400.3, 2400.6,
2400.9, 2400.12, 2400.15, 2400.18, 2500.1, 2600.1-
2600.3, 2600.6, 2600.9, 2600.12, 2600.15, 2600.18,
2700.1

Kobe Source 2100.1-2100.3, 2100.6, 2200.1-2200.3,
2200.6, 2300.1-2300.3, 2400.1-2400.3, 2400.6, 2400.9,
2400.12, 2400.15, 2400.18, 2500.1, 2600.1-2600.3,
2600.6, 2600.9, 2600.12, 2600.15, 2600.18, 2700.1

KONKUL-1 Reference 3100.1-3100.11, 3200.1-
3200.21, 7400.1-7400.11, 7500.1-7500.21, 7600.1-

7600.21, 7700.1-7700.21, 9200.1-9200.21, 9300.1-9300.21

L

L467OV559 Lot ID 19600.1-19600.6

L-50N Filler Name 13800.8-13800.36, 14200.1-14200.48

Ladle Composition Position 1100.1-1100.2,

1100.5-1100.6, 1200.1-1200.2, 1200.5-1200.6, 1300.1-1300.2, 1300.5-1300.6, 1400.1-1400.2, 1400.5-1400.6, 1500.1-1500.2, 1500.5-1500.6, 1600.1-1600.2, 1600.5-1600.6, 1700.1-1700.2, 1700.5-1700.6, 1800.1-1800.2, 1800.5-1800.6, 1900.1-1900.2, 1900.5-1900.6, 15500.1-15500.2, 15500.5-15500.7, 15600.1-15600.6, 16700.1-16700.28, 16800.1-16800.7, 16900.1-16900.7, 17000.1-17000.11, 17100.1-17100.19, 17200.1-17200.46, 17300.1-17300.19, 17400.1-17400.28, 17500.1-17500.19, 17600.1-17600.7, 17700.1-17700.28, 17800.1-17800.7, 17900.1-17900.46, 18000.1-18000.11, 18100.1-18100.11, 18200.1-18200.28, 18300.1-18300.46, 18400.1-18400.28, 18500.1-18500.7

Linc 860 Flux Name 7200.7-7200.8, 7200.13

Linc 880 Flux Name 11500.4-11500.6

Linc 882 Flux Name 10900.4-10900.6

Linde166p Flux Name 10200.4-10200.6, 10800.4-10800.6, 11000.4-11000.6, 12300.4-12300.6

Linde709-5 Flux Name 9900.7-9900.9

LindeWS Filler Name 8000.1, 8000.4, 8100.1, 8100.4, 8200.1, 8200.4, 8600.1, 8600.4, 8700.1, 8700.4

Loading Type

I 18600.2, 18700.1, 18800.2, 18900.2, 19000.3, 19100.3, 19200.3, 19300.3, 19400.3, 19600.2, 19600.9, 19600.15

Slow 2000.3, 7000.2, 14700.2, 14700.11, 14700.20, 14800.2, 14800.11, 14800.20, 14900.2, 14900.11, 15000.2, 15000.11, 15000.20, 15100.2, 15100.11, 15100.20, 15200.2, 15200.11

Location

B 1000.2, 1000.6

T 1000.1-1000.3, 1000.9, 1000.12-1000.14

Location wrt Surface

1/4T 7200.7-7200.8, 7200.13

Back surface at root 14200.16, 14200.38, 14300.16, 14300.38, 14400.16, 14400.38, 14500.16-14500.24, 14500.36-14500.44, 14600.16-14600.24, 14600.36-14600.44, 14700.8, 14700.17, 14700.26, 14800.8, 14800.17, 14800.26, 14900.8, 14900.17, 15000.8, 15000.17, 15000.26, 15100.8, 15100.17, 15100.26, 15200.8, 15200.17

Back surface not root 13800.20-13800.22, 14200.18-14200.26, 14200.40-14200.48, 14300.18-14300.26, 14300.40-14300.48, 14400.18-14400.26, 14400.40-14400.48

Final surface 11500.4-11500.6, 12300.4-12300.14, 13800.8-13800.18, 13800.24-13800.32, 13900.1, 13900.4-13900.22, 14000.4-14000.22, 14200.6-14200.14, 14200.28-14200.36, 14300.6-14300.14, 14300.28-14300.36, 14400.6-14400.14, 14400.28-14400.36, 14500.6-14500.14, 14500.26-14500.34, 14600.6-14600.14, 14600.26-14600.34, 14700.3, 14700.12, 14700.21, 14800.3, 14800.12, 14800.21, 14900.3, 14900.12, 15000.3, 15000.12, 15000.21, 15100.3, 15100.12, 15100.21, 15200.3, 15200.12

Full cross section 13800.34-13800.36, 13900.24-13900.26, 14000.1-14000.3, 14200.1-14200.5, 14300.1-14300.5, 14400.1-14400.5, 14500.1-14500.5, 14600.1-14600.5, 14600.46-14600.47

Mid thickness at root 3100.2-3100.10, 7400.2-7400.10, 7600.2-7600.20, 9200.2-9200.20, 9900.7-9900.9, 10200.4-10200.6

Mid thickness not root 2500.1, 2500.4, 2500.7, 2500.10, 2500.13, 2500.16, 2700.1, 2700.4, 2700.7, 2700.10, 2700.13, 2700.16, 3200.1, 3200.4-3200.20, 6400.4, 6400.7, 6400.10, 6400.13, 6400.16, 6400.19-6400.21, 6500.1, 6500.4, 6600.1, 6600.4, 6700.1, 6700.4, 6800.1, 6800.4, 7500.1, 7500.4-7500.20, 7700.1, 7700.4-7700.20, 8000.1, 8000.4, 8100.1, 8100.4, 8200.1, 8200.4, 8300.1, 8300.4, 8500.1, 8500.4, 8600.1, 8600.4, 8700.1, 8700.4, 8800.1, 8800.4, 9300.1, 9300.4-9300.20, 9700.7-9700.9, 10200.8-10200.10, 14700.6, 14700.15, 14700.24, 14800.6, 14800.15, 14800.24, 14900.6, 14900.15, 15000.6, 15000.15, 15000.24, 15100.6, 15100.15, 15100.24, 15200.6, 15200.15

Surface 14700.1, 14700.11, 14700.20, 14800.1, 14800.11, 14800.20, 14900.1, 14900.11, 15000.1, 15000.11, 15000.20, 15100.1, 15100.11, 15100.20, 15200.1, 15200.11

Location wrt Weld

11mm in HAZ 2500.16, 2700.16, 3200.1, 3200.8, 3200.12, 3200.16, 3200.20, 6400.4, 6400.10, 6400.16, 6500.1, 6600.1, 6700.1, 6800.1, 7200.7-7200.8, 7500.1, 7500.6, 7500.12, 7500.16, 7500.20, 7600.2, 7600.6, 7600.10, 7600.14, 7600.18, 7700.1, 7700.6, 7700.10, 7700.14, 7700.18, 8000.1, 8100.1, 8200.1, 8300.1, 8500.1, 8600.1, 8700.1, 8800.1, 9200.2, 9200.6, 9200.10, 9200.14, 9200.18, 9300.1, 9300.6, 9300.10, 9300.14, 9300.18, 9700.7, 9900.7, 10200.4, 10200.8, 10500.4, 10800.4, 10900.4, 11000.4, 11500.4, 12300.4, 12300.8, 12300.12, 13800.8, 13800.20, 13800.24, 13800.34, 13900.1, 13900.14, 13900.24, 14000.1, 14000.4, 14000.14, 14200.1, 14200.4-14200.6, 14200.16-14200.18, 14200.28, 14200.38-14200.40, 14300.1, 14300.4-14300.6, 14300.16-14300.18, 14300.28, 14300.38-14300.40, 14400.1, 14400.4-14400.6, 14400.16-14400.18, 14400.28,

14400.38-14400.40, 14500.1, 14500.4-14500.6, 14500.16, 14500.26, 14500.36, 14600.1, 14600.4-14600.6, 14600.16, 14600.26, 14600.36, 14700.1-14700.3, 14700.6- 14700.8, 14700.11-14700.12, 14700.15-14700.17, 14700.20-14700.21, 14700.24-14700.26, 14800.1- 14800.3, 14800.6-14800.8, 14800.11-14800.12, 14800.15- 14800.17, 14800.20-14800.21, 14800.24-14800.26, 14900.1-14900.3, 14900.6-14900.8, 14900.11-14900.12, 14900.15-14900.17, 15000.1-15000.3, 15000.6-15000.8, 15000.11-15000.12, 15000.15-15000.17, 15000.20- 15000.21, 15000.24-15000.26, 15100.1-15100.3, 15100.6-15100.8, 15100.11-15100.12, 15100.15- 15100.17, 15100.20-15100.21, 15100.24-15100.26, 15200.1-15200.3, 15200.6-15200.8, 15200.11-15200.12, 15200.15-15200.17, 16500.1, 16500.5, 19000.1, 19100.1, 19200.1, 19300.1, 19400.1, 19600.7, 19600.14	14500.28, 14500.38, 14600.3-14600.5, 14600.8, 14600.18, 14600.28, 14600.38
1mm in HAZ 2500.4, 2700.4, 6400.7, 6400.13, 6400.19-6400.21, 6500.4, 6600.4, 6700.4, 6800.4, 7200.13, 8000.4, 8100.4, 8200.4, 8300.4, 8500.4, 8600.4, 8700.4, 8800.4, 13800.12, 13800.28, 13900.6, 13900.18, 14000.8, 14000.18, 14200.10, 14200.22, 14200.32, 14200.44, 14300.10, 14300.22, 14300.32, 14300.44, 14400.10, 14400.22, 14400.32, 14400.44, 14500.10, 14500.20, 14500.30, 14500.40, 14600.10, 14600.20, 14600.30, 14600.40	Transverse 14500.46-14500.47, 14600.46-14600.47
3mm in HAZ 2500.7, 2700.7, 13800.14, 13800.30, 13900.8, 13900.20, 14000.10, 14000.20, 14200.12, 14200.24, 14200.34, 14200.46, 14300.12, 14300.24, 14300.34, 14300.46, 14400.12, 14400.24, 14400.34, 14400.46, 14500.12, 14500.22, 14500.32, 14500.42, 14600.12, 14600.22, 14600.32, 14600.42	Lot ID
50% weld, 50% HAZ 13800.18, 13900.12	0 3800.1-3800.4
5mm in HAZ 2500.10, 2700.10, 13800.16, 13800.32, 13900.10, 13900.22, 14000.12, 14000.22, 14200.14, 14200.26, 14200.36, 14200.48, 14300.14, 14300.26, 14300.36, 14300.48, 14400.14, 14400.26, 14400.36, 14400.48, 14500.14, 14500.24, 14500.34, 14500.44, 14600.14, 14600.24, 14600.34, 14600.44	1 3900.1-3900.3
7mm in HAZ 2500.13, 2700.13	11672 3400.1-3400.4
Fusion line 2500.1, 2700.1, 3100.2-3100.10, 3200.4-3200.6, 3200.10, 3200.14, 3200.18, 7400.2- 7400.10, 7500.4, 7500.8-7500.10, 7500.14, 7500.18, 7600.4, 7600.8, 7600.12, 7600.16, 7600.20, 7700.4, 7700.8, 7700.12, 7700.16, 7700.20, 9200.4, 9200.8, 9200.12, 9200.16, 9200.20, 9300.4, 9300.8, 9300.12, 9300.16, 9300.20, 9700.9, 9900.9, 10200.6, 10200.10, 10500.6, 10800.6, 10900.6, 11000.6, 11500.6, 12300.6, 12300.10, 12300.14, 13800.10, 13800.22, 13800.26, 13800.36, 13900.4, 13900.16, 13900.26, 14000.3, 14000.6, 14000.16, 14200.3-14200.5, 14200.8, 14200.20, 14200.30, 14200.42, 14300.3-14300.5, 14300.8, 14300.20, 14300.30, 14300.42, 14400.3-14400.5, 14400.8, 14400.20, 14400.30, 14400.42, 14500.3-14500.5, 14500.8, 14500.18,	11682 4600.1-4600.3
	11692 4200.1-4200.3
	14320 3600.1-3600.4
	14453 4500.1-4500.4
	14460 3300.1-3300.4
	14490 5700.1-5700.3
	14500 6000.1-6000.3
	17754 5800.1-5800.3, 6100.1-6100.3
	17777 6200.1-6200.3
	17846 5900.1-5900.3
	18553 6300.1-6300.3
	40574 12000.1-12000.3, 12100.1-12100.3, 12200.1- 12200.3
	41509 10200.1-10200.11
	42252 10800.1-10800.7, 10900.1-10900.7, 11000.1- 11000.7
	43731 5400.1-5400.3
	43752 3500.1-3500.4
	47444 11200.1-11200.6
	47574 9600.1-9600.7, 9700.1-9700.10, 9800.1- 9800.3
	48160 9900.1-9900.10, 10000.1-10000.5, 10100.1- 10100.5
	48682 11500.1-11500.7, 11600.1-11600.3
	50054 10300.1-10300.3, 10400.1-10400.3, 10500.1- 10500.7
	52100 12400.1-12400.3
	52110 12300.1-12300.15
	52765 5600.1-5600.3
	52797 5500.1-5500.3
	54614 11100.1-11100.4
	55946 11800.1-11800.6, 11900.1-11900.6
	57053 11700.1-11700.6
	57221 9400.1-9400.3, 9500.1-9500.6
	58568 11300.1-11300.3, 11400.1-11400.3
	59609 10300.4-10300.6, 10600.1-10600.4, 10700.1- 10700.7
	60865 4300.1-4300.3
	60868 3700.1-3700.4, 4400.1-4400.4
	641661 1100.1-1100.2, 1100.5-1100.6, 1200.1- 1200.2, 1200.5-1200.6, 1300.1-1300.2, 1300.5-1300.6
	641662 1400.1-1400.2, 1400.5-1400.6, 1500.1- 1500.2, 1500.5-1500.6, 1600.1-1600.2, 1600.5-1600.6
	642696 1800.1-1800.2, 1800.5-1800.6, 1900.1- 1900.2, 1900.5-1900.6
	642697 1700.1-1700.2, 1700.5-1700.6

- A** 5200.1-5200.4
A0161 7800.1-7800.6
A1579-2AA 15900.1-15900.6
A6175-8 16100.1-16100.3, 16100.6-16100.8
A6670-3A 16400.1-16400.6
A6670-3B 16300.1-16300.6
B0469-2C 15400.1-15400.6, 16200.1-16200.6
B1038-2B 18600.1-18600.6
B-1088-3 18800.1-18800.6
B-1088-5 18900.1-18900.6
B1908-3 15500.1-15500.2, 15500.5-15500.7
B1908-5A 15600.1-15600.6
B1908-5B 15800.1-15800.3, 15800.6-15800.8
B5761-2R 19500.1-19500.7
B8478-3 17800.1-17800.7
B8490-2 17500.1-17500.19
B8563-4 17300.1-17300.19
B8601-5 17100.1-17100.19
B8687-1 17600.1-17600.7
B8740-2 17200.1-17200.46
B8740-3 16700.1-16700.28
B8817-1 18400.1-18400.28
B9353-3 16600.1-16600.7
B9671-1E 12600.1-12600.14
C 4000.1-4000.3
C4771-39A 18500.1-18500.7
C5830 16000.1-16000.6
C5830-5T 15300.1-15300.6
C-9283-11 18700.1-18700.5
D2580-4 17400.1-17400.28
D3007-3 15700.1-15700.3, 15700.6-15700.8
D3631-7L 16900.1-16900.7
D3667-3M 17000.1-17000.11
D3703-4B 16800.1-16800.7
D3710-42B 17900.1-17900.46
D3791-2B 7300.1-7300.6
D3974-1B 18200.1-18200.28
D3975-3E 17700.1-17700.28
D4030-4A 18300.1-18300.46
D4179-3B 7900.1-7900.6
D6274-4 9000.1-9000.2, 9000.5-9000.9, 9100.1-9100.3, 9100.6-9100.9
D6873-1A 12500.1-12500.6
D6873-1B 12700.1-12700.7
DO733-1D 18000.1-18000.11
E 5300.1-5300.4
FRM 19000.1-19000.7
FRN 19100.1-19100.7
FRO 19600.7-19600.13
FRP 19600.14-19600.21
FVD 19200.1-19200.7
FXF 19400.1-19400.7
FXG 19300.1-19300.7
- G** 4100.1-4100.3
G9011 2300.1-2300.8
G9837 2600.1-2600.20, 2700.1-2700.18
H 5000.1-5000.4
I 5100.1-5100.4
J131267 1000.1-1000.14
K1325 2400.1-2400.20, 2500.1-2500.18
k21-6425 3000.1-3000.8
K21-7102 2900.1-2900.8
K22-6296 2800.1-2800.8
KB6479 2100.1-2100.8, 2200.1-2200.8
L467OV559 19600.1-19600.6
N8686-5 18100.1-18100.11
P 4900.1-4900.3
S 4800.1-4800.3
T 4700.1-4700.3
- LR3201 Reference** 7300.1-7300.6
Lukens Producer 7300.1, 7800.1, 7900.1, 9000.1, 9100.1, 12500.1, 12600.1, 12700.1, 15300.1, 15400.1, 15500.1, 15600.1, 15700.1, 15800.1, 15900.1, 16000.1, 16100.1, 16200.1, 16300.1, 16400.1, 16600.1, 19500.1
Lukens Source 7300.1, 7800.1, 7900.1, 9000.1, 9100.1, 12500.1, 12600.1, 12700.1, 15300.1, 15400.1, 15500.1, 15600.1, 15700.1, 15800.1, 15900.1, 16000.1, 16100.1, 16200.1, 16300.1, 16400.1, 16600.1, 19500.1
- M**
M22000/10 Filler Specification 19600.7, 19600.14
M22000/1E Filler Specification 19000.1
Material Code
001.001.09B 16500.1-16500.4
001.001.09F 16500.5-16500.7
001.002.01 16600.1-16600.7
001.003.01B1 16700.20-16700.22
001.003.01B2 16700.26-16700.28
001.003.01BM 16700.23-16700.25
001.003.01M1 16700.11-16700.13
001.003.01M2 16700.17-16700.19
001.003.01MM 16700.14-16700.16
001.003.01T1 16700.1-16700.4
001.003.01T2 16700.8-16700.10
001.003.01TM 16700.5-16700.7
001.004.01B2 16800.5-16800.7
001.004.01T1 16800.1-16800.4
001.005.01B2 16900.5-16900.7
001.005.01T1 16900.1-16900.4
001.006.01B2 17000.7-17000.11
001.006.01T1 17000.1-17000.6
001.007.01B1 17100.11-17100.13
001.007.01B2 17100.17-17100.19
001.007.01BM 17100.14-17100.16
001.007.01T1 17100.1-17100.4
001.007.01T2 17100.8-17100.10

001.007.01TM	17100.5-17100.7	001.016.01B2	18000.7-18000.11
001.008.01B1	17200.32-17200.36	001.016.01T1	18000.1-18000.6
001.008.01B2	17200.42-17200.46	001.017.01B2	18100.7-18100.11
001.008.01BM	17200.37-17200.41	001.017.01T1	18100.1-18100.6
001.008.01M1	17200.17-17200.21	001.018.01B1	18200.20-18200.22
001.008.01M2	17200.27-17200.31	001.018.01B2	18200.26-18200.28
001.008.01MM	17200.22-17200.26	001.018.01BM	18200.23-18200.25
001.008.01T1	17200.1-17200.6	001.018.01M1	18200.11-18200.13
001.008.01T2	17200.12-17200.16	001.018.01M2	18200.17-18200.19
001.008.01TM	17200.7-17200.11	001.018.01MM	18200.14-18200.16
001.009.01B1	17300.11-17300.13	001.018.01T1	18200.1-18200.4
001.009.01B2	17300.17-17300.19	001.018.01T2	18200.8-18200.10
001.009.01BM	17300.14-17300.16	001.018.01TM	18200.5-18200.7
001.009.01T1	17300.1-17300.4	001.019.01B1	18300.32-18300.36
001.009.01T2	17300.8-17300.10	001.019.01B2	18300.42-18300.46
001.009.01TM	17300.5-17300.7	001.019.01BM	18300.37-18300.41
001.010.01B1	17400.20-17400.22	001.019.01M1	18300.17-18300.21
001.010.01B2	17400.26-17400.28	001.019.01M2	18300.27-18300.31
001.010.01BM	17400.23-17400.25	001.019.01MM	18300.22-18300.26
001.010.01M1	17400.11-17400.13	001.019.01T1	18300.1-18300.6
001.010.01M2	17400.17-17400.19	001.019.01T2	18300.12-18300.16
001.010.01MM	17400.14-17400.16	001.019.01TM	18300.7-18300.11
001.010.01T1	17400.1-17400.4	001.020.01B1	18400.20-18400.22
001.010.01T2	17400.8-17400.10	001.020.01B2	18400.26-18400.28
001.010.01TM	17400.5-17400.7	001.020.01BM	18400.23-18400.25
001.011.01B1	17500.11-17500.13	001.020.01M1	18400.11-18400.13
001.011.01B2	17500.17-17500.19	001.020.01M2	18400.17-18400.19
001.011.01BM	17500.14-17500.16	001.020.01MM	18400.14-18400.16
001.011.01T1	17500.1-17500.4	001.020.01T1	18400.1-18400.4
001.011.01T2	17500.8-17500.10	001.020.01T2	18400.8-18400.10
001.011.01TM	17500.5-17500.7	001.020.01TM	18400.5-18400.7
001.012.01B2	17600.5-17600.7	001.021.01B2	18500.5-18500.7
001.012.01T1	17600.1-17600.4	001.021.01T1	18500.1-18500.4
001.013.01B1	17700.20-17700.22	001.023.01	18600.1-18600.6
001.013.01B2	17700.26-17700.28	001.024.01	18700.1-18700.5
001.013.01BM	17700.23-17700.25	001.025.01	18800.1-18800.6
001.013.01M1	17700.11-17700.13	001.026.01	18900.1-18900.6
001.013.01M2	17700.17-17700.19	001.027.09	19000.1-19000.7
001.013.01MM	17700.14-17700.16	001.028.09	19100.1-19100.7
001.013.01T1	17700.1-17700.4	001.029.09	19200.1-19200.7
001.013.01T2	17700.8-17700.10	001.030.09	19300.1-19300.7
001.013.01TM	17700.5-17700.7	001.031.09	19400.1-19400.7
001.014.01B2	17800.5-17800.7	002.001.01A1	9400.1-9400.3
001.014.01T1	17800.1-17800.4	002.001.01B1	9500.1-9500.3
001.015.01B1	17900.32-17900.36	002.001.01B2	9500.4-9500.6
001.015.01B2	17900.42-17900.46	002.002.01A1	9600.1-9600.3
001.015.01BM	17900.37-17900.41	002.002.01A2	9600.4-9600.7
001.015.01M1	17900.17-17900.21	002.002.01B1	9700.1-9700.3
001.015.01M2	17900.27-17900.31	002.002.01B2	9700.4-9700.6
001.015.01MM	17900.22-17900.26	002.002.01C1	9800.1-9800.3
001.015.01T1	17900.1-17900.6	002.002.02B2	9700.9-9700.10
001.015.01T2	17900.12-17900.16	002.002.09B2	9700.7-9700.8
001.015.01TM	17900.7-17900.11	002.003.01A1	9900.1-9900.3

002.003.01A2	9900.4-9900.6	002.017.01C1	12400.1-12400.3
002.003.01B1	10000.1-10000.5	002.018.01	12500.1-12500.6
002.003.01C1	10100.1-10100.5	002.019.01	12600.1-12600.2, 12600.13-12600.14
002.003.02A1	9900.9-9900.10	002.019.01B	12600.6-12600.8, 12600.11-12600.12
002.003.09A1	9900.7-9900.8	002.019.01T	12600.3-12600.5, 12600.9-12600.10
002.004.01A1	10200.1-10200.3	002.020.01	12700.1-12700.7
002.004.02AAA	10200.10-10200.11	002.021.01	12800.1-12800.5
002.004.02ABA	10200.6-10200.7	002.022.01	12900.1-12900.5
002.004.09AAA	10200.8-10200.9	002.023.01	13000.1-13000.5
002.004.09ABA	10200.4-10200.5	002.024.01	13100.1-13100.5
002.005.01A1	10300.1-10300.3	002.025.01	13200.1-13200.3
002.005.01B1	10400.1-10400.3	002.026.01	13300.1-13300.5
002.005.01C1	10500.1-10500.3	002.027.01	13400.1-13400.5
002.005.02C	10500.6-10500.7	002.028.01	13500.1-13500.5
002.005.09C	10500.4-10500.5	002.029.01	13600.1-13600.5
002.006.01A1	10300.4-10300.6	002.030.01	13700.1-13700.3
002.006.01B1	10600.1-10600.4	003.001.01	7100.1-7100.6
002.006.01C1	10700.1-10700.3	003.002.01	7200.1-7200.6
002.006.01C2	10700.4-10700.7	003.002.03.1	7200.13-7200.16
002.007.01A1	10800.1-10800.3	003.002.09	7200.7
002.007.01B1	10900.1-10900.3	003.002.09.1	7200.8-7200.12
002.007.01C1	11000.1-11000.3	003.003.01	7300.1-7300.6
002.007.02AAA	10800.6-10800.7	004.001.01B	1000.2, 1000.6-1000.8
002.007.02BAA	10900.6-10900.7	004.001.01T	1000.1-1000.5, 1000.14
002.007.02CAA	11000.6-11000.7	004.001.01TS1	1000.9-1000.11
002.007.09AAA	10800.4-10800.5	004.001.01TS2	1000.12-1000.13
002.007.09BAA	10900.4-10900.5	004.002.01.1	1100.1-1100.2, 1100.5-1100.6
002.007.09CAA	11000.4-11000.5	004.002.01.2	1200.1-1200.2, 1200.5-1200.6
002.008.01C1	11100.1-11100.4	004.002.01.6	1300.1-1300.2, 1300.5-1300.6
002.009.01B1	11200.1-11200.3	004.003.01.1	1400.1-1400.2, 1400.5-1400.6
002.009.01B2	11200.4-11200.6	004.003.01.2	1500.1-1500.2, 1500.5-1500.6
002.010.01B1	11300.1-11300.3	004.003.01.7	1600.1-1600.2, 1600.5-1600.6
002.010.01C1	11400.1-11400.3	004.004.01.1	1700.1-1700.2, 1700.5-1700.6
002.011.01B1	11500.1-11500.3	004.005.01.1	1800.1-1800.2, 1800.5-1800.6
002.011.01C1	11600.1-11600.3	004.005.01.7	1900.1-1900.2, 1900.5-1900.6
002.011.02B1	11500.6-11500.7	007.001.01B	2100.2, 2100.6-2100.8
002.011.09B1	11500.4-11500.5	007.001.01T	2100.1-2100.5
002.012.01B1	11700.1-11700.3	007.002.01B	2200.2, 2200.6-2200.8
002.012.01B2	11700.4-11700.6	007.002.01T	2200.1-2200.5
002.013.01B1	11800.1-11800.4	007.003.01B	2300.2, 2300.6-2300.8
002.013.01B2	11800.5-11800.6	007.003.01T	2300.1-2300.5
002.013.01C1	11900.1-11900.3	007.004.01B	2400.2, 2400.6-2400.8, 2400.12- 2400.14, 2400.18-2400.20
002.013.01C2	11900.4-11900.6	007.004.01T	2400.1-2400.5, 2400.9-2400.11, 2400.15-2400.17
002.014.01B1	12000.1-12000.3	007.004.02.1	2500.1-2500.3
002.014.01C1	12100.1-12100.3	007.004.03.1	2500.4-2500.6
002.015.01C1	12200.1-12200.3	007.004.04.1	2500.7-2500.9
002.016.01C1	12300.1-12300.3	007.004.05.1	2500.10-2500.12
002.016.02CAA	12300.14-12300.15	007.004.06.1	2500.13-2500.15
002.016.02CAS	12300.10-12300.11	007.004.09.1	2500.16-2500.18
002.016.02CBA	12300.6-12300.7	007.005.01B	2600.2, 2600.6-2600.8, 2600.12- 2600.14, 2600.18-2600.20
002.016.09CAA	12300.12-12300.13		
002.016.09CAS	12300.8-12300.9		
002.016.09CBA	12300.4-12300.5		

007.005.01T	2600.1-2600.5, 2600.9-2600.11, 2600.15-2600.17	009.033.01	5600.1-5600.3
007.005.02.1	2700.1-2700.3	009.034.01	5700.1-5700.3
007.005.03.1	2700.4-2700.6	009.035.01	5800.1-5800.3
007.005.04.1	2700.7-2700.9	009.036.01	5900.1-5900.3
007.005.05.1	2700.10-2700.12	009.037.01	6000.1-6000.3
007.005.06.1	2700.13-2700.15	009.038.01	6100.1-6100.3
007.005.09.1	2700.16-2700.18	009.039.01	6200.1-6200.3
007.007.01B	2800.2, 2800.6-2800.8	009.040.01	6300.1-6300.3
007.007.01T	2800.1-2800.5	009.041.01	6400.1-6400.3
007.008.01B	2900.2, 2900.6-2900.8	009.041.03A	6400.7-6400.9
007.008.01T	2900.1-2900.5	009.041.03B	6400.13-6400.15
007.009.01B	3000.2, 3000.6-3000.8	009.041.03C	6400.19-6400.20
007.009.01T	3000.1-3000.5	009.041.03D	6400.21-6400.23
009.002.010A	3100.1	009.041.09A	6400.4-6400.6
009.002.02AA	3100.8-3100.9	009.041.09B	6400.10-6400.12
009.002.02AS1	3100.2-3100.3	009.041.09C	6400.16-6400.18
009.002.02AS2	3100.4-3100.5	009.042.01	6900.1-6900.2
009.002.02AS3	3100.6-3100.7	009.042.03A	6500.4-6500.5
009.002.02AS4	3100.10-3100.11	009.042.03B	6600.4-6600.5
009.002.02BS1	3200.6-3200.7	009.042.03C	6700.4-6700.5
009.002.02BS2	3200.10-3200.11	009.042.03D	6800.4-6800.6
009.002.02BS3	3200.14-3200.15	009.042.09A	6500.1-6500.3
009.002.02BS4	3200.18-3200.19	009.042.09B	6600.1-6600.3
009.002.02BW	3200.4-3200.5	009.042.09C	6700.1-6700.3
009.002.09BS1	3200.20-3200.21	009.042.09D	6800.1-6800.3
009.002.09BS2	3200.8-3200.9	009.043.010A	7000.1-7000.2, 7000.5-7000.6
009.002.09BS3	3200.12-3200.13	010.001.010A	13800.2, 13800.5-13800.7, 13800.37
009.002.09BS4	3200.16-3200.17	010.001.010S	13800.1-13800.4
009.002.09BW	3200.1-3200.3	010.001.02ABA	13800.22-13800.23
009.010.01	3300.1-3300.4	010.001.02AFA	13800.10-13800.11
009.011.01	3400.1-3400.4	010.001.02AFS	13800.26-13800.27
009.012.01	3500.1-3500.4	010.001.02ANA	13800.36
009.013.01	3600.1-3600.4	010.001.02BFA	13900.4-13900.5
009.014.01	3700.1-3700.4	010.001.02BFS	13900.16-13900.17
009.015.01	3800.1-3800.4	010.001.02BNA	13900.26
009.016.01	3900.1-3900.3	010.001.02CFA	14000.6-14000.7
009.017.01	4000.1-4000.3	010.001.02CFS	14000.16-14000.17
009.018.01	4100.1-4100.3	010.001.02CNA	14000.3
009.019.01	4200.1-4200.3	010.001.03AFA	13800.12-13800.13
009.020.01	4300.1-4300.3	010.001.03AFS	13800.28-13800.29
009.021.01	4400.1-4400.4	010.001.03BFA	13900.6-13900.7
009.022.01	4500.1-4500.4	010.001.03BFS	13900.18-13900.19
009.023.01	4600.1-4600.3	010.001.03CFA	14000.8-14000.9
009.024.01	4700.1-4700.3	010.001.03CFS	14000.18-14000.19
009.025.01	4800.1-4800.3	010.001.04AFA	13800.14-13800.15
009.026.01	4900.1-4900.3	010.001.04AFS	13800.30-13800.31
009.027.01	5000.1-5000.4	010.001.04BFA	13900.8-13900.9
009.028.01	5100.1-5100.4	010.001.04BFS	13900.20-13900.21
009.029.01	5200.1-5200.4	010.001.04CFA	14000.10-14000.11
009.030.01	5300.1-5300.4	010.001.04CFS	14000.20-14000.21
009.031.01	5400.1-5400.3	010.001.05AFA	13800.16-13800.17
009.032.01	5500.1-5500.3	010.001.05AFS	13800.32-13800.33
		010.001.05BFA	13900.10-13900.11

010.001.05BFS	13900.22-13900.23	010.002.03DFS	14200.32-14200.33
010.001.05CFA	14000.12-14000.13	010.002.03EBA	14300.22-14300.23
010.001.05CFS	14000.22-14000.23	010.002.03EBS	14300.44-14300.45
010.001.09ABA	13800.20-13800.21	010.002.03EFA	14300.10-14300.11
010.001.09AFA	13800.8-13800.9	010.002.03EFS	14300.32-14300.33
010.001.09AFS	13800.24-13800.25	010.002.03FBA	14400.22-14400.23
010.001.09ANA	13800.34	010.002.03FBS	14400.44-14400.45
010.001.09BFA	13900.1-13900.3	010.002.03FFA	14400.10-14400.11
010.001.09BFS	13900.14-13900.15	010.002.03FFS	14400.32-14400.33
010.001.09BNA	13900.24	010.002.03GFA	14500.10-14500.11
010.001.09CFA	14000.4-14000.5	010.002.03GFS	14500.30-14500.31
010.001.09CFS	14000.14-14000.15	010.002.03GRA	14500.20-14500.21
010.001.09CNA	14000.1	010.002.03GRS	14500.40-14500.41
010.001.11AFA	13800.18-13800.19	010.002.03HFA	14600.10-14600.11
010.001.11BFA	13900.12-13900.13	010.002.03HFS	14600.30-14600.31
010.002.010A	14100.1-14100.3	010.002.03HRA	14600.20-14600.21
010.002.010C	14100.5-14100.6	010.002.03HRS	14600.40-14600.41
010.002.010D	14100.7-14100.8	010.002.04DBA	14200.24-14200.25
010.002.010E	14100.9-14100.10	010.002.04DBS	14200.46-14200.47
010.002.010S	14100.4	010.002.04DFA	14200.12-14200.13
010.002.02DBA	14200.20-14200.21	010.002.04DFS	14200.34-14200.35
010.002.02DBS	14200.42-14200.43	010.002.04EBA	14300.24-14300.25
010.002.02DFA	14200.8-14200.9	010.002.04EBS	14300.46-14300.47
010.002.02DFS	14200.30-14200.31	010.002.04EFA	14300.12-14300.13
010.002.02DNA	14200.3	010.002.04EFS	14300.34-14300.35
010.002.02DNS	14200.5	010.002.04FBA	14400.24-14400.25
010.002.02EBA	14300.20-14300.21	010.002.04FBS	14400.46-14400.47
010.002.02EBS	14300.42-14300.43	010.002.04FFA	14400.12-14400.13
010.002.02EFA	14300.8-14300.9	010.002.04FFS	14400.34-14400.35
010.002.02EFS	14300.30-14300.31	010.002.04GFA	14500.12-14500.13
010.002.02ENA	14300.3	010.002.04GFS	14500.32-14500.33
010.002.02ENS	14300.5	010.002.04GRA	14500.22-14500.23
010.002.02FBA	14400.20-14400.21	010.002.04GRS	14500.42-14500.43
010.002.02FBS	14400.42-14400.43	010.002.04HFA	14600.12-14600.13
010.002.02FFA	14400.8-14400.9	010.002.04HFS	14600.32-14600.33
010.002.02FFS	14400.30-14400.31	010.002.04HRA	14600.22-14600.23
010.002.02FNA	14400.3	010.002.04HRS	14600.42-14600.43
010.002.02FNS	14400.5	010.002.05DBA	14200.26-14200.27
010.002.02GFA	14500.8-14500.9	010.002.05DBS	14200.48-14200.49
010.002.02GFS	14500.28-14500.29	010.002.05DFA	14200.14-14200.15
010.002.02GNA	14500.3	010.002.05DFS	14200.36-14200.37
010.002.02GNS	14500.5	010.002.05EBA	14300.26-14300.27
010.002.02GRA	14500.18-14500.19	010.002.05EBS	14300.48-14300.49
010.002.02GRS	14500.38-14500.39	010.002.05EFA	14300.14-14300.15
010.002.02HFA	14600.8-14600.9	010.002.05EFS	14300.36-14300.37
010.002.02HFS	14600.28-14600.29	010.002.05FBA	14400.26-14400.27
010.002.02HNA	14600.3	010.002.05FBS	14400.48-14400.49
010.002.02HNS	14600.5	010.002.05FFA	14400.14-14400.15
010.002.02HRA	14600.18-14600.19	010.002.05FFS	14400.36-14400.37
010.002.02HRS	14600.38-14600.39	010.002.05GFA	14500.14-14500.15
010.002.03DBA	14200.22-14200.23	010.002.05GFS	14500.34-14500.35
010.002.03DBS	14200.44-14200.45	010.002.05GRA	14500.24-14500.25
010.002.03DFA	14200.10-14200.11	010.002.05GRS	14500.44-14500.45

010.002.05HFA	14600.14-14600.15	010.003.09CFA	14700.21-14700.23
010.002.05HFS	14600.34-14600.35	010.003.09CMA	14700.24-14700.25
010.002.05HRA	14600.24-14600.25	010.003.09CSA	14700.20
010.002.05HRS	14600.44-14600.45	010.003.09DBRA	14800.8-14800.10
010.002.09DBA	14200.18-14200.19	010.003.09DFA	14800.3-14800.5
010.002.09DBS	14200.40-14200.41	010.003.09DMA	14800.6-14800.7
010.002.09DFA	14200.6-14200.7	010.003.09DSA	14800.1
010.002.09DFS	14200.28-14200.29	010.003.09EBRA	14800.17-14800.19
010.002.09DNA	14200.1	010.003.09EFA	14800.12-14800.14
010.002.09DNS	14200.4	010.003.09EMA	14800.15-14800.16
010.002.09DRA	14200.16-14200.17	010.003.09ESA	14800.11
010.002.09DRS	14200.38-14200.39	010.003.09FBRA	14800.26-14800.28
010.002.09EBA	14300.18-14300.19	010.003.09FFA	14800.21-14800.23
010.002.09EBS	14300.40-14300.41	010.003.09FMA	14800.24-14800.25
010.002.09EFA	14300.6-14300.7	010.003.09FSA	14800.20
010.002.09EFS	14300.28-14300.29	010.003.09GBRA	14900.8-14900.10
010.002.09ENA	14300.1	010.003.09GFA	14900.3-14900.5
010.002.09ENS	14300.4	010.003.09GMA	14900.6-14900.7
010.002.09ERA	14300.16-14300.17	010.003.09GSA	14900.1
010.002.09ERS	14300.38-14300.39	010.003.09HBRA	14900.17-14900.19
010.002.09FBA	14400.18-14400.19	010.003.09HFA	14900.12-14900.14
010.002.09FBS	14400.40-14400.41	010.003.09HMA	14900.15-14900.16
010.002.09FFA	14400.6-14400.7	010.003.09HSA	14900.11
010.002.09FFS	14400.28-14400.29	010.003.09IBRA	15000.8-15000.10
010.002.09FNA	14400.1	010.003.09IFA	15000.3-15000.5
010.002.09FNS	14400.4	010.003.09IMA	15000.6-15000.7
010.002.09FRA	14400.16-14400.17	010.003.09ISA	15000.1
010.002.09FRS	14400.38-14400.39	010.003.09JBRA	15000.17-15000.19
010.002.09GFA	14500.6-14500.7	010.003.09JFA	15000.12-15000.14
010.002.09GFS	14500.26-14500.27	010.003.09JMA	15000.15-15000.16
010.002.09GNA	14500.1	010.003.09JSA	15000.11
010.002.09GNS	14500.4	010.003.09KBRA	15000.26-15000.28
010.002.09GRA	14500.16-14500.17	010.003.09KFA	15000.21-15000.23
010.002.09GRS	14500.36-14500.37	010.003.09KMA	15000.24-15000.25
010.002.09HFA	14600.6-14600.7	010.003.09KSA	15000.20
010.002.09HFS	14600.26-14600.27	010.003.09LBRA	15100.8-15100.10
010.002.09HNA	14600.1	010.003.09LFA	15100.3-15100.5
010.002.09HNS	14600.4	010.003.09LMA	15100.6-15100.7
010.002.09HRA	14600.16-14600.17	010.003.09LSA	15100.1
010.002.09HRS	14600.36-14600.37	010.003.09MBRA	15100.17-15100.19
010.002.10GSA	14500.46	010.003.09MFA	15100.12-15100.14
010.002.10GSS	14500.47	010.003.09MMA	15100.15-15100.16
010.002.10HSA	14600.46	010.003.09MSA	15100.11
010.002.10HSS	14600.47	010.003.09NBRA	15100.26-15100.28
010.003.09ABRA	14700.8-14700.10	010.003.09NFA	15100.21-15100.23
010.003.09AFA	14700.3-14700.5	010.003.09NMA	15100.24-15100.25
010.003.09AMA	14700.6-14700.7	010.003.09NSA	15100.20
010.003.09ASA	14700.1	010.003.09PBRA	15200.8-15200.10
010.003.09BBRA	14700.17-14700.19	010.003.09PFA	15200.3-15200.5
010.003.09BFA	14700.12-14700.14	010.003.09PMA	15200.6-15200.7
010.003.09BMA	14700.15-14700.16	010.003.09PSA	15200.1
010.003.09BSA	14700.11	010.003.09QBRA	15200.17-15200.19
010.003.09CBRA	14700.26-14700.28	010.003.09QFA	15200.12-15200.14

010.003.09QMA	15200.15-15200.16	012.005.09AS3	9200.14-9200.15
010.003.09QSA	15200.11	012.005.09AS4	9200.18-9200.19
010.004.01	15300.1-15300.6	012.005.09BA	9300.1-9300.3
010.005.01	15400.1-15400.6	012.005.09BS1	9300.6-9300.7
010.006.01	15500.1-15500.2, 15500.5-15500.7	012.005.09BS2	9300.10-9300.11
010.007.01	15600.1-15600.6	012.005.09BS3	9300.14-9300.15
010.008.01	15700.1-15700.3, 15700.6-15700.8	012.005.09BS4	9300.18-9300.19
010.009.01	15800.1-15800.3, 15800.6-15800.8	013.004.010A	7400.1
010.010.01	15900.1-15900.6	013.004.02AS1	7400.4-7400.5
010.011.01	16000.1-16000.6	013.004.02AS2	7400.6-7400.7
010.012.01	16100.1-16100.3, 16100.6-16100.8	013.004.02AS3	7400.8-7400.9
010.013.01	16200.1-16200.6	013.004.02AS4	7400.10-7400.11
010.014.01	16300.1-16300.6	013.004.02AW	7400.2-7400.3
010.015.01	16400.1-16400.6	013.004.02BA	7500.4-7500.5
011.001.01	19500.1-19500.7	013.004.02BS2	7500.10-7500.11
011.003.01	19600.1-19600.6	013.004.02BS3	7500.14-7500.15
011.003.09A	19600.7-19600.13, 19600.16-19600.17	013.004.02BS4	7500.18-7500.19
011.003.09B	19600.14-19600.15, 19600.18-19600.21	013.004.09BA	7500.1-7500.3
012.001.01	8400.1-8400.2	013.004.09BS1	7500.6-7500.7
012.001.03A	8000.4-8000.5	013.004.09BS2	7500.8-7500.9, 7500.20-7500.21
012.001.03B	8100.4-8100.5	013.004.09BS3	7500.12-7500.13
012.001.03C	8200.4-8200.5	013.004.09BS4	7500.16-7500.17
012.001.03D	8300.4-8300.5	016.001.010A	7600.1
012.001.03E	8500.4-8500.5	016.001.02AA	7600.4-7600.5
012.001.09A	8000.1-8000.3	016.001.02AS1	7600.8-7600.9
012.001.09B	8100.1-8100.3	016.001.02AS2	7600.12-7600.13
012.001.09C	8200.1-8200.3	016.001.02AS3	7600.16-7600.17
012.001.09D	8300.1-8300.3	016.001.02AS4	7600.20-7600.21
012.001.09E	8500.1-8500.3	016.001.02BA	7700.4-7700.5
012.002.01	8900.1-8900.2	016.001.02BS1	7700.8-7700.9
012.002.03A	8600.4-8600.5	016.001.02BS2	7700.12-7700.13
012.002.03B	8700.4-8700.5	016.001.02BS3	7700.16-7700.17
012.002.03C	8800.4-8800.5	016.001.02BS4	7700.20-7700.21
012.002.09A	8600.1-8600.3	016.001.09AA	7600.2-7600.3
012.002.09B	8700.1-8700.3	016.001.09AS1	7600.6-7600.7
012.002.09C	8800.1-8800.3	016.001.09AS2	7600.10-7600.11
012.003.01	9000.1-9000.2, 9000.5-9000.9	016.001.09AS3	7600.14-7600.15
012.004.01	9100.1-9100.3, 9100.6-9100.9	016.001.09AS4	7600.18-7600.19
012.005.010A	9200.1	016.001.09BA	7700.1-7700.3
012.005.02AA	9200.4-9200.5	016.001.09BS1	7700.6-7700.7
012.005.02AS1	9200.8-9200.9	016.001.09BS2	7700.10-7700.11
012.005.02AS2	9200.12-9200.13	016.001.09BS3	7700.14-7700.15
012.005.02AS3	9200.16-9200.17	016.001.09BS4	7700.18-7700.19
012.005.02AS4	9200.20-9200.21	016.002.01	7800.1-7800.6
012.005.02BA	9300.4-9300.5	016.003.01	7900.1-7900.6
012.005.02BS1	9300.8-9300.9	032.001.01	2000.1-2000.9
012.005.02BS2	9300.12-9300.13		
012.005.02BS3	9300.16-9300.17		
012.005.02BS4	9300.20-9300.21		
012.005.09AA	9200.2-9200.3		
012.005.09AS1	9200.6-9200.7		
012.005.09AS2	9200.10-9200.11		

Material Name

A36 3100.1-3100.11, 3200.1-3200.21, 3300.1-3300.4, 3400.1-3400.4, 3500.1-3500.4, 3600.1-3600.4, 3700.1-3700.4, 3800.1-3800.4, 3900.1-3900.3, 4000.1-4000.3, 4100.1-4100.3, 4200.1-4200.3, 4300.1-4300.3, 4400.1-4400.4, 4500.1-4500.4, 4600.1-4600.3, 4700.1-4700.3, 4800.1-4800.3, 4900.1-4900.3, 5000.1-5000.4,

- 5100.1-5100.4, 5200.1-5200.4, 5300.1-5300.4, 5400.1-5400.3, 5500.1-5500.3, 5600.1-5600.3, 5700.1-5700.3, 5800.1-5800.3, 5900.1-5900.3, 6000.1-6000.3, 6100.1-6100.3, 6200.1-6200.3, 6300.1-6300.3, 6400.1-6400.23, 6500.1-6500.5, 6600.1-6600.5, 6700.1-6700.5, 6800.1-6800.6, 6900.1-6900.2, 7000.1-7000.2, 7000.5-7000.6
- A537 CL1** 7300.1-7300.6, 7400.1-7400.11, 7500.1-7500.21
- A572 Gr50** 7600.1-7600.21, 7700.1-7700.21, 7800.1-7800.6, 7900.1-7900.6
- A588** 8000.1-8000.5, 8100.1-8100.5, 8200.1-8200.5, 8300.1-8300.5, 8400.1-8400.2, 8500.1-8500.5, 8600.1-8600.5, 8700.1-8700.5, 8800.1-8800.5, 8900.1-8900.2, 9000.1-9000.2, 9000.5-9000.9, 9100.1-9100.3, 9100.6-9100.9
- A588 GrA** 9200.1-9200.21, 9300.1-9300.21
- A710** 9400.1-9400.3, 9500.1-9500.6, 9600.1-9600.7, 9700.1-9700.10, 9800.1-9800.3, 9900.1-9900.10, 10000.1-10000.5, 10100.1-10100.5, 10200.1-10200.11, 10300.1-10300.6, 10400.1-10400.3, 10500.1-10500.7, 10600.1-10600.4, 10700.1-10700.7, 10800.1-10800.7, 10900.1-10900.7, 11000.1-11000.7, 11100.1-11100.4, 11200.1-11200.6, 11300.1-11300.3, 11400.1-11400.3, 11500.1-11500.7, 11600.1-11600.3, 11700.1-11700.6, 11800.1-11800.6, 11900.1-11900.6, 12000.1-12000.3, 12100.1-12100.3, 12200.1-12200.3, 12300.1-12300.15, 12400.1-12400.3, 12700.1-12700.7, 12800.1-12800.5, 12900.1-12900.5, 13000.1-13000.5, 13100.1-13100.5, 13200.1-13200.3, 13300.1-13300.5, 13400.1-13400.5, 13500.1-13500.5, 13600.1-13600.5, 13700.1-13700.3
- A710-A** 12500.1-12500.6, 12600.1-12600.14
- ABS-B** 1000.1-1000.14, 1100.1-1100.2, 1100.5-1100.6, 1200.1-1200.2, 1200.5-1200.6, 1300.1-1300.2, 1300.5-1300.6, 1400.1-1400.2, 1400.5-1400.6, 1500.1-1500.2, 1500.5-1500.6, 1600.1-1600.2, 1600.5-1600.6, 1700.1-1700.2, 1700.5-1700.6, 1800.1-1800.2, 1800.5-1800.6, 1900.1-1900.2, 1900.5-1900.6
- ABS-EH32** 2000.1-2000.9
- ABS-EH36** 2100.1-2100.8, 2200.1-2200.8, 2300.1-2300.8, 2400.1-2400.20, 2500.1-2500.18, 2600.1-2600.20, 2700.1-2700.18, 2800.1-2800.8, 2900.1-2900.8, 3000.1-3000.8
- BS4360 Gr50D** 13800.1-13800.37, 13900.1-13900.26, 14000.1-14000.23, 14100.1-14100.10, 14200.1-14200.49, 14300.1-14300.49, 14400.1-14400.49, 14500.1-14500.47, 14600.1-14600.47, 14700.1-14700.28, 14800.1-14800.28, 14900.1-14900.19, 15000.1-15000.28, 15100.1-15100.28, 15200.1-15200.19, 15300.1-15300.6, 15400.1-15400.6, 15500.1-15500.2, 15500.5-15500.7, 15600.1-15600.6, 15700.1-15700.3, 15700.6-15700.8, 15800.1-15800.3, 15800.6-15800.8, 15900.1-15900.6, 16000.1-16000.6, 16100.1-16100.3, 16100.6-16100.8, 16200.1-16200.6, 16300.1-16300.6, 16400.1-16400.6
- CG A537M** 7100.1-7100.6, 7200.1-7200.16
- HY100** 19500.1-19500.7, 19600.1-19600.21
- HY80** 16500.1-16500.7, 16600.1-16600.7, 16700.1-16700.28, 16800.1-16800.7, 16900.1-16900.7, 17000.1-17000.11, 17100.1-17100.19, 17200.1-17200.46, 17300.1-17300.19, 17400.1-17400.28, 17500.1-17500.19, 17600.1-17600.7, 17700.1-17700.28, 17800.1-17800.7, 17900.1-17900.46, 18000.1-18000.11, 18100.1-18100.11, 18200.1-18200.28, 18300.1-18300.46, 18400.1-18400.28, 18500.1-18500.7, 18600.1-18600.6, 18700.1-18700.5, 18800.1-18800.6, 18900.1-18900.6, 19000.1-19000.7, 19100.1-19100.7, 19200.1-19200.7, 19300.1-19300.7, 19400.1-19400.7
- Maximum Curve Shape** 15000.2, 15000.20
- Melting Practice**
- BOF** 1000.1-1000.3, 1000.6, 1000.9, 1000.12-1000.14, 1100.1, 1200.1, 1300.1, 1400.1, 1500.1, 1600.1, 1700.1, 1800.1, 1900.1, 2100.1-2100.3, 2100.6, 2200.1-2200.3, 2200.6, 2300.1-2300.3, 2400.1-2400.3, 2400.6, 2400.9, 2400.12, 2400.15, 2400.18, 2500.1, 2600.1-2600.3, 2600.6, 2600.9, 2600.12, 2600.15, 2600.18, 2700.1
- electric furnace** 5400.1, 5500.1, 5600.1
- open hearth** 3300.1, 3400.1, 3500.1, 3600.1, 3700.1, 4200.1, 4300.1, 4400.1, 4500.1, 4600.1, 5700.1, 5800.1, 5900.1, 6000.1, 6100.1, 6200.1, 6300.1
- METZ/MPC13 Reference** 2000.1-2000.9
- Mid Ingot Position** 16700.11, 17200.17, 17400.11, 17700.11, 17900.17, 18200.11, 18300.17, 18400.11
- Mid thickness at root Location wrt Surface** 3100.2-3100.10, 7400.2-7400.10, 7600.2-7600.20, 9200.2-9200.20, 9900.7-9900.9, 10200.4-10200.6
- Mid thickness not root Location wrt Surface** 2500.1, 2500.4, 2500.7, 2500.10, 2500.13, 2500.16, 2700.1, 2700.4, 2700.7, 2700.10, 2700.13, 2700.16, 3200.1, 3200.4-3200.20, 6400.4, 6400.7, 6400.10, 6400.13, 6400.16, 6400.19-6400.21, 6500.1, 6500.4, 6600.1, 6600.4, 6700.1, 6700.4, 6800.1, 6800.4, 7500.1, 7500.4-7500.20, 7700.1, 7700.4-7700.20, 8000.1, 8000.4, 8100.1, 8100.4, 8200.1, 8200.4, 8300.1, 8300.4, 8500.1, 8500.4, 8600.1, 8600.4, 8700.1, 8700.4, 8800.1, 8800.4, 9300.1, 9300.4-9300.20, 9700.7-9700.9, 10200.8-10200.10, 14700.6, 14700.15, 14700.24, 14800.6, 14800.15, 14800.24, 14900.6, 14900.15, 15000.6, 15000.15, 15000.24, 15100.6, 15100.15, 15100.24, 15200.6, 15200.15
- Minsy Producer** 19300.1, 19400.1
- Modified Standard JIcpr** 18600.2, 18700.1, 18800.2, 18900.2, 19000.3, 19100.3, 19200.3, 19300.3, 19400.3, 19600.2, 19600.9, 19600.15

N

- N Final Processing** 2000.1, 2800.1-2800.3, 2800.6, 2900.1-2900.3, 2900.6, 3000.1-3000.3, 3000.6, 7300.1, 7400.1, 7500.1, 9000.1, 9100.1, 9200.1, 9300.1, 13800.2, 13800.5, 13900.1, 14000.4, 14100.1, 14200.1, 14300.1, 14400.1, 14500.1, 14600.1, 15300.1, 15400.1, 15700.1, 15800.1, 15900.1, 16000.1, 16100.1, 16200.1, 16300.1
- N Heat Treatment** 7300.1, 9000.1, 9100.1, 15700.1, 15800.1, 15900.1, 16000.1, 16100.1, 16200.1, 16300.1
- N8686-5 Lot ID** 18100.1-18100.11
- N,A Final Processing** 13800.1-13800.3, 14100.4-14100.5
- N,C,A Final Processing** 14100.7-14100.9
- NGESW Weld Type** 6400.10, 6400.13, 6400.16, 6400.19-6400.21, 6600.1, 6600.4, 6700.1, 6700.4, 6800.1, 6800.4, 8100.1, 8100.4, 8200.1, 8200.4, 8300.1, 8300.4, 8500.1, 8500.4, 8700.1, 8700.4, 8800.1, 8800.4
- Nil Ductilty Transition Test Type** 1000.14, 1100.6, 1200.6, 1300.6, 1400.6, 1500.6, 1600.6, 1700.6, 1800.6, 1900.6, 2000.7, 3300.1, 3400.1, 3500.1, 3600.1, 3700.1, 3800.1, 3900.1, 4000.1, 4100.1, 4200.1, 4300.1, 4400.1, 4500.1, 4600.1, 4700.1, 4800.1, 4900.1, 5000.1, 5100.1, 5200.1, 5300.1, 5400.1, 5500.1, 5600.1, 5700.1, 5800.1, 5900.1, 6000.1, 6100.1, 6200.1, 6300.1, 7100.4, 7200.4, 7200.10, 10000.5, 10100.5, 10600.4, 10700.7, 11100.4, 11800.4, 11900.6, 13800.7, 14100.2
- Nk203NiC Filler Name** 14700.1-14700.3, 14700.6-14700.8, 14700.11-14700.12, 14700.15-14700.17, 14700.20-14700.21, 14700.24-14700.26, 14800.1-14800.3, 14800.6-14800.8, 14800.11-14800.12, 14800.15-14800.17, 14800.20-14800.21, 14800.24-14800.26, 14900.1-14900.3, 14900.6-14900.8, 14900.11-14900.12, 14900.15-14900.17, 15000.1-15000.3, 15000.6-15000.8, 15000.11-15000.12, 15000.15-15000.17, 15000.20-15000.21, 15000.24-15000.26, 15100.1-15100.3, 15100.6-15100.8, 15100.11-15100.12, 15100.15-15100.17, 15100.20-15100.21, 15100.24-15100.26, 15200.1-15200.3, 15200.6-15200.8, 15200.11-15200.12, 15200.15-15200.17
- No Did Specimen Split?** 8000.2-8000.4, 8100.2-8100.4, 8200.2-8200.4, 8300.2-8300.4, 8400.1, 8500.2-8500.4, 8600.2-8600.4, 8700.2-8700.4, 8800.2-8800.4, 8900.1
- No Groove Joint Preparation** 6600.1, 6600.4, 6700.1, 6700.4, 6800.1, 6800.4, 8100.1, 8100.4, 8200.1, 8200.4, 8300.1, 8300.4, 8500.1, 8500.4, 8700.1, 8700.4, 8800.1, 8800.4
- None Shielding Gas** 10500.4-10500.6
- Notch Preparation**
Pressed 7100.5, 7200.5, 7200.11, 7200.15, 7300.5, 7800.5, 7900.5, 9000.7, 9100.7, 12500.5, 12600.9-12600.13, 12700.6, 12800.4, 12900.4, 13000.4, 13100.4, 13300.4, 13400.4, 13500.4, 13600.4, 15300.5, 15400.5, 15500.6, 15600.5, 15700.7, 15800.7, 15900.5, 16000.5, 16100.7, 16200.5, 16300.5, 16400.5, 17000.5, 17000.10, 17200.5, 17200.10, 17200.15, 17200.20, 17200.25, 17200.30, 17200.35, 12600.13, 12700.6, 12800.4, 12900.4, 13000.4, 13100.4, 13300.4, 13400.4, 13500.4, 15500.6, 15600.5, 15700.7, 17900.10, 17900.15, 17900.20, 17900.25, 17900.30, 17900.35, 17900.40, 17900.45, 18000.5, 18000.10, 18100.5, 18100.10, 18300.5, 18300.10, 18300.15, 18300.20, 18300.25, 18300.30, 18300.35, 18300.40, 18300.45, 18600.5, 18700.4, 18800.5, 18900.5, 19000.6, 19100.6, 19200.6, 19300.6, 19400.6, 19500.2, 19600.5, 19600.12, 19600.20
- O**
- OGC Source** 6400.1, 6500.1, 6600.1, 6700.1, 6800.1, 6900.1, 8000.1, 8100.1, 8200.1, 8300.1, 8400.1, 8500.1, 8600.1, 8700.1, 8800.1, 8900.1
- OGC-1 Reference** 6400.1-6400.23, 6500.1-6500.5, 6600.1-6600.5, 6700.1-6700.5, 6800.1-6800.6, 6900.1-6900.2, 8000.1-8000.5, 8100.1-8100.5, 8200.1-8200.5, 8300.1-8300.5, 8400.1-8400.2, 8500.1-8500.5, 8600.1-8600.5, 8700.1-8700.5, 8800.1-8800.5, 8900.1-8900.2
- open hearth Melting Practice** 3300.1, 3400.1, 3500.1, 3600.1, 3700.1, 4200.1, 4300.1, 4400.1, 4500.1, 4600.1, 5700.1, 5800.1, 5900.1, 6000.1, 6100.1, 6200.1, 6300.1
- OrStMills Producer** 6400.1, 8600.1, 8700.1, 8800.1, 8900.1
- P**
- P Lot ID** 4900.1-4900.3
- P-1 Specimen Type** 1000.14, 1100.6, 1200.6, 1300.6, 1400.6, 1500.6, 1600.6, 1700.6, 1800.6, 1900.6, 13800.7, 14100.2
- P-2 Specimen Type** 10600.4, 10700.7, 11100.4, 11800.4, 11900.6
- P-3 Specimen Type** 7100.4, 7200.4, 7200.10, 10000.5, 10100.5
- Per Standard JIcpr** 7800.2, 7900.2, 9000.6, 9100.2, 12500.2, 12600.2, 12700.2, 15700.2, 15800.2, 15900.2, 16100.2
- P&EStat Source** 16500.1
- PFH-60A Filler Specification** 2500.1, 2500.4, 2500.7, 2500.10, 2500.13, 2500.16, 2700.1, 2700.4, 2700.7, 2700.10, 2700.13, 2700.16
- Pressed Notch Preparation** 7100.5, 7200.5, 7200.11, 7200.15, 7300.5, 7800.5, 7900.5, 9000.7, 9100.7, 12500.5, 12600.9-12600.13, 12700.6, 12800.4, 12900.4, 13000.4, 13100.4, 13300.4, 13400.4, 13500.4, 13600.4, 15300.5, 15400.5, 15500.6, 15600.5, 15700.7, 15800.7, 15900.5, 16000.5, 16100.7, 16200.5, 16300.5, 16400.5, 17000.5, 17000.10, 17200.5, 17200.10, 17200.15, 17200.20, 17200.25, 17200.30, 17200.35,

17200.40, 17200.45, 17900.5, 17900.10, 17900.15,
17900.20, 17900.25, 17900.30, 17900.35, 17900.40,
17900.45, 18000.5, 18000.10, 18100.5, 18100.10,
18300.5, 18300.10, 18300.15, 18300.20, 18300.25,
18300.30, 18300.35, 18300.40, 18300.45, 18600.5,
18700.4, 18800.5, 18900.5, 19000.6, 19100.6, 19200.6,
19300.6, 19400.6, 19500.2, 19600.5, 19600.12, 19600.20

Producer

Armco 2000.1, 3300.1, 3400.1, 3500.1, 3600.1,
3700.1, 3800.1, 3900.1, 4000.1, 4100.1, 4200.1,
4300.1, 4400.1, 4500.1, 4600.1, 4700.1, 4800.1,
4900.1, 5000.1, 5100.1, 5200.1, 5300.1, 5400.1,
5500.1, 5600.1, 5700.1, 5800.1, 5900.1, 6000.1,
6100.1, 6200.1, 6300.1, 7100.1, 7200.1

Australia 1100.1, 1200.1, 1300.1, 1400.1, 1500.1,
1600.1, 1700.1, 1800.1, 1900.1

Bunge 16500.1

DTNSRDC 19000.1, 19100.1, 19200.1

Kobe 2100.1-2100.3, 2100.6, 2200.1-2200.3, 2200.6,
2300.1-2300.3, 2400.1-2400.3, 2400.6, 2400.9, 2400.12,
2400.15, 2400.18, 2500.1, 2600.1-2600.3, 2600.6,
2600.9, 2600.12, 2600.15, 2600.18, 2700.1

Lukens 7300.1, 7800.1, 7900.1, 9000.1, 9100.1,
12500.1, 12600.1, 12700.1, 15300.1, 15400.1, 15500.1,
15600.1, 15700.1, 15800.1, 15900.1, 16000.1, 16100.1,
16200.1, 16300.1, 16400.1, 16600.1, 19500.1

Minsy 19300.1, 19400.1

OrStMills 6400.1, 8600.1, 8700.1, 8800.1, 8900.1

Sumitomo 1000.1-1000.3, 1000.6, 1000.9, 1000.12-
1000.14, 2800.1-2800.3, 2800.6, 2900.1-2900.3,
2900.6, 3000.1-3000.3, 3000.6, 13800.1-13800.5,
13800.34, 13900.1, 13900.24, 14000.1, 14000.4,
14100.1, 14100.4-14100.9, 14200.1, 14300.1, 14400.1,
14500.1, 14600.1

US Steel 3100.1, 3200.1, 6500.1, 6600.1, 6700.1,
6800.1, 6900.1, 7000.1, 7400.1, 7500.1, 7600.1,
7700.1, 8000.1, 8100.1, 8200.1, 8300.1, 8400.1,
8500.1, 9200.1, 9300.1

Q

Q,K Final Processing 12500.1, 12700.1

Q,K Heat Treatment 9400.1, 9500.1, 9500.4,
9600.1, 9700.1, 9700.4, 9800.1, 9900.1, 9900.4,
9900.7, 10000.1, 10100.1, 10200.1, 10300.1, 10300.4,
10400.1, 10500.1, 10600.1, 10700.1, 10700.4, 10800.1,
10900.1, 11000.1, 11100.1, 11200.1, 11200.4, 11300.1,
11400.1, 11500.1, 11600.1, 11700.1, 11800.1, 11800.5,
11900.1, 11900.4, 12000.1, 12100.1, 12200.1, 12300.1,
12400.1, 12500.1, 12700.1

Q,T Final Processing 2100.1-2100.3, 2100.6,
2200.1-2200.3, 2200.6, 2300.1-2300.3, 2400.1-2400.3,
2400.6, 2400.9, 2400.12, 2400.15, 2400.18, 2500.1,
2600.1-2600.3, 2600.6, 2600.9, 2600.12, 2600.15,

2600.18, 2700.1, 7100.1, 7200.1, 12600.1, 16400.1,
18600.1, 18700.1, 18800.1, 18900.1, 19500.1, 19600.1

Q,T Heat Treatment 7100.1, 7200.1, 12600.1,
15300.1, 15400.1, 15500.1, 15600.1, 16400.1, 18600.1,
18700.1, 18800.1, 18900.1, 19500.1, 19600.1

Q,T,W Final Processing 19600.7

Q,T,W Heat Treatment 19600.7

R**Reference**

004-2 1100.1-1100.2, 1100.5-1100.6, 1200.1-
1200.2, 1200.5-1200.6, 1300.1-1300.2, 1300.5-1300.6,
1400.1-1400.2, 1400.5-1400.6, 1500.1-1500.2, 1500.5-
1500.6, 1600.1-1600.2, 1600.5-1600.6, 1700.1-1700.2,
1700.5-1700.6, 1800.1-1800.2, 1800.5-1800.6, 1900.1-
1900.2, 1900.5-1900.6

007-1 2100.1-2100.8, 2200.1-2200.8, 2300.1-
2300.8, 2400.1-2400.20, 2500.1-2500.18, 2600.1-
2600.20, 2700.1-2700.18

007-4 2800.1-2800.8, 2900.1-2900.8, 3000.1-
3000.8

1010 7800.1-7800.6, 7900.1-7900.6

1120 16600.1-16600.7

1211 9000.1-9000.2, 9000.5-9000.9, 9100.1-9100.3,
9100.6-9100.9

3200 12600.1-12600.14

3201 15400.1-15400.6, 15700.1-15700.3, 15700.6-
15700.8, 15800.1-15800.3, 15800.6-15800.8, 15900.1-
15900.6, 16000.1-16000.6, 16100.1-16100.3, 16100.6-
16100.8, 16200.1-16200.6, 16300.1-16300.6

3202 15300.1-15300.6, 15500.1-15500.2, 15500.5-
15500.7, 15600.1-15600.6, 16400.1-16400.6

3400 12500.1-12500.6, 12700.1-12700.7

3530 19500.1-19500.7

Armco-MPC 3300.1-3300.4, 3400.1-3400.4,
3500.1-3500.4, 3600.1-3600.4, 3700.1-3700.4, 3800.1-
3800.4, 3900.1-3900.3, 4000.1-4000.3, 4100.1-4100.3,
4200.1-4200.3, 4300.1-4300.3, 4400.1-4400.4, 4500.1-
4500.4, 4600.1-4600.3, 4700.1-4700.3, 4800.1-4800.3,
4900.1-4900.3, 5000.1-5000.4, 5100.1-5100.4, 5200.1-
5200.4, 5300.1-5300.4, 5400.1-5400.3, 5500.1-5500.3,
5600.1-5600.3, 5700.1-5700.3, 5800.1-5800.3, 5900.1-
5900.3, 6000.1-6000.3, 6100.1-6100.3, 6200.1-6200.3,
6300.1-6300.3

KONKUL-1 3100.1-3100.11, 3200.1-3200.21,
7400.1-7400.11, 7500.1-7500.21, 7600.1-7600.21,
7700.1-7700.21, 9200.1-9200.21, 9300.1-9300.21

LR3201 7300.1-7300.6

METZ/MPC13 2000.1-2000.9

OGC-1 6400.1-6400.23, 6500.1-6500.5, 6600.1-
6600.5, 6700.1-6700.5, 6800.1-6800.6, 6900.1-6900.2,
8000.1-8000.5, 8100.1-8100.5, 8200.1-8200.5, 8300.1-
8300.5, 8400.1-8400.2, 8500.1-8500.5, 8600.1-8600.5,

- 8700.1-8700.5, 8800.1-8800.5, 8900.1-8900.2
- S-1971** 1000.1-1000.14
- SHI-01** 13800.1-13800.37, 13900.1-13900.26,
14000.1-14000.23, 14100.1-14100.10, 14200.1-14200.49,
14300.1-14300.49, 14400.1-14400.49, 14500.1-14500.47,
14600.1-14600.47
- SSC-276** 7100.1-7100.6
- USN 6/9** 18600.1-18600.6, 18700.1-18700.5,
18800.1-18800.6, 18900.1-18900.6, 19000.1-19000.7,
19100.1-19100.7, 19200.1-19200.7, 19300.1-19300.7,
19400.1-19400.7, 19600.1-19600.21
- USN 9/9** 12800.1-12800.5, 12900.1-12900.5,
13000.1-13000.5, 13100.1-13100.5, 13200.1-13200.3,
13300.1-13300.5, 13400.1-13400.5, 13500.1-13500.5,
13600.1-13600.5, 13700.1-13700.3
- USN-1** 16700.1-16700.28, 16800.1-16800.7, 16900.1-
16900.7, 17000.1-17000.11, 17100.1-17100.19, 17200.1-
17200.46, 17300.1-17300.19, 17400.1-17400.28,
17500.1-17500.19, 17600.1-17600.7, 17700.1-17700.28,
17800.1-17800.7, 17900.1-17900.46, 18000.1-18000.11,
18100.1-18100.11, 18200.1-18200.28, 18300.1-18300.46,
18400.1-18400.28, 18500.1-18500.7
- WJ,3/87** 16500.1-16500.7
- WJ,7/87** 14700.1-14700.28, 14800.1-14800.28,
14900.1-14900.19, 15000.1-15000.28, 15100.1-15100.28,
15200.1-15200.19
- Round Specimen Type** 2800.1-2800.2, 2900.1-
2900.2, 3000.1-3000.2, 7100.1, 7200.1, 7200.7,
14100.1, 14100.4
- ## S
- S Lot ID** 4800.1-4800.3
- S-1971 Reference** 1000.1-1000.14
- SAW Weld Type** 2500.1, 2500.4, 2500.7, 2500.10,
2500.13, 2500.16, 2700.1, 2700.4, 2700.7, 2700.10,
2700.13, 2700.16, 3200.1, 3200.4-3200.20, 7200.7-
7200.8, 7200.13, 7500.1, 7500.4-7500.20, 7700.1,
7700.4-7700.20, 9300.1, 9300.4-9300.20, 10200.4-
10200.6, 10800.4-10800.6, 10900.4-10900.6, 11000.4-
11000.6, 11500.4-11500.6, 12300.4-12300.6, 13900.1,
13900.4-13900.26, 14300.1-14300.48, 14500.1-14500.47
- SHI-01 Reference** 13800.1-13800.37, 13900.1-
13900.26, 14000.1-14000.23, 14100.1-14100.10,
14200.1-14200.49, 14300.1-14300.49, 14400.1-14400.49,
14500.1-14500.47, 14600.1-14600.47
- Shielding Gas**
- None** 10500.4-10500.6
- Si-Al Killing Process** 7400.1, 7500.1
- Silicon Killing Process** 1000.1-1000.3, 1000.6,
1000.9, 1000.12-1000.14
- SK Killing Process** 3300.1, 3400.1, 3500.1, 3600.1,
3700.1, 3800.1, 3900.1, 4000.1, 4100.1, 4200.1,
4300.1, 4400.1, 4500.1, 4600.1, 4700.1, 4800.1,
4900.1, 5000.1, 5100.1, 5200.1, 5300.1
- Slow Loading Type** 2000.3, 7000.2, 14700.2,
14700.11, 14700.20, 14800.2, 14800.11, 14800.20,
14900.2, 14900.11, 15000.2, 15000.11, 15000.20,
15100.2, 15100.11, 15100.20, 15200.2, 15200.11
- SMA Weld Type** 3100.2-3100.10, 7400.2-7400.10,
7600.2-7600.20, 9200.2-9200.20, 13800.8-13800.36,
14200.1-14200.48, 16500.1, 16500.5, 19000.1, 19100.1,
19200.1, 19300.1, 19400.1, 19600.7, 19600.14
- SMAW Weld Type** 9700.7-9700.9, 10200.8-10200.10,
10500.4-10500.6, 12300.8-12300.14
- SMAW/SAW Weld Type** 9900.7-9900.9
- Smooth Butt Joint Preparation** 6400.4, 6400.7,
6400.10, 6400.13, 6400.16, 6400.19-6400.21, 6500.1,
6500.4, 8000.1, 8000.4, 8600.1, 8600.4, 10200.4-
10200.6
- Source**
- Armco** 2000.1, 3300.1, 3400.1, 3500.1, 3600.1
- Armco D&M** 3700.1, 3800.1, 3900.1, 4000.1,
4100.1, 4200.1, 4300.1, 4400.1, 4500.1, 4600.1,
4700.1, 4800.1, 4900.1, 5000.1, 5100.1, 5200.1,
5300.1, 5400.1, 5500.1, 5600.1, 5700.1, 5800.1,
5900.1, 6000.1, 6100.1, 6200.1, 6300.1
- Australia** 1100.1, 1200.1, 1300.1, 1400.1, 1500.1,
1600.1, 1700.1, 1800.1, 1900.1
- HIFAB** 14700.1, 14800.1, 14900.1, 15000.1,
15100.1, 15200.1
- Kobe** 2100.1-2100.3, 2100.6, 2200.1-2200.3, 2200.6,
2300.1-2300.3, 2400.1-2400.3, 2400.6, 2400.9, 2400.12,
2400.15, 2400.18, 2500.1, 2600.1-2600.3, 2600.6,
2600.9, 2600.12, 2600.15, 2600.18, 2700.1
- Lukens** 7300.1, 7800.1, 7900.1, 9000.1, 9100.1,
12500.1, 12600.1, 12700.1, 15300.1, 15400.1, 15500.1,
15600.1, 15700.1, 15800.1, 15900.1, 16000.1, 16100.1,
16200.1, 16300.1, 16400.1, 16600.1, 19500.1
- OGC** 6400.1, 6500.1, 6600.1, 6700.1, 6800.1,
6900.1, 8000.1, 8100.1, 8200.1, 8300.1, 8400.1,
8500.1, 8600.1, 8700.1, 8800.1, 8900.1
- P&EStat** 16500.1
- Sumitomo** 1000.1-1000.3, 1000.6, 1000.9, 1000.12-
1000.14, 2800.1-2800.3, 2800.6, 2900.1-2900.3,
2900.6, 3000.1-3000.3, 3000.6, 13800.1-13800.5,
13800.34, 13900.1, 13900.24, 14000.1, 14000.4,
14100.1, 14100.4-14100.9, 14200.1, 14300.1, 14400.1,
14500.1, 14600.1
- SWRI** 7100.1, 7200.1
- Un Kansas** 7000.1
- US Steel** 3100.1, 3200.1, 7400.1, 7500.1, 7600.1,
7700.1, 9200.1, 9300.1
- USN** 12800.1, 12900.1, 13000.1, 13100.1, 13200.1,
13300.1, 13400.1, 13500.1, 13600.1, 13700.1, 18600.1,
18700.1, 18800.1, 18900.1, 19000.1, 19100.1, 19200.1,
19300.1, 19400.1, 19600.1, 19600.7

Specimen Type

2/3	9400.2, 9600.2	4300.2, 4400.2, 4500.2, 4600.2, 4700.2, 4800.2,
3/4	9500.2, 9500.5, 9700.2, 9700.5-9700.9, 9800.2,	4900.2, 5000.2, 5100.2, 5200.2, 5300.2, 5400.2,
	9900.2, 9900.5-9900.9, 10200.2-10200.10, 11300.2,	5500.2, 5600.2, 5700.2, 5800.2, 5900.2, 6000.2,
	11400.2, 11500.2, 11600.2, 11700.2, 11700.5	6100.2, 6200.2, 6300.2, 6400.1, 6400.4, 6400.7,
Compact	7800.2, 9000.6, 9100.2, 12500.2, 12600.2,	6400.10, 6400.13, 6400.16, 6400.19-6400.21, 6500.2-
	12700.2, 15700.2, 15800.2, 15900.2, 16100.2	6500.4, 6600.2-6600.4, 6700.2-6700.4, 6800.2-6800.4,
Compact Tension	18600.2, 18700.1, 18800.2,	6900.1, 7000.5, 7100.2, 7200.2, 7200.8, 7200.13,
	18900.2, 19000.3, 19100.3, 19200.3, 19300.3, 19400.3,	7300.2, 7400.2-7400.10, 7500.2-7500.20, 7600.2-
	19600.2, 19600.9, 19600.15	7600.20, 7700.2-7700.20, 7800.3, 7900.3, 8000.2-
Cylindrical	3100.1, 7000.1, 7300.1, 7400.1,	8000.4, 8100.2-8100.4, 8200.2-8200.4, 8300.2-8300.4,
	7600.1, 7800.1, 7900.1, 9000.1, 9100.1, 9200.1,	8400.1, 8500.2-8500.4, 8600.2-8600.4, 8700.2-8700.4,
	12500.1, 12600.1, 12700.1, 14700.3, 14700.8, 14700.12,	8800.2-8800.4, 8900.1, 9000.2, 9100.3, 9200.2-
	14700.17, 14700.21, 14700.26, 14800.3, 14800.8,	9200.20, 9300.2-9300.20, 10100.2, 10300.2, 10300.5,
	14800.12, 14800.17, 14800.21, 14800.26, 14900.3,	10400.2, 10500.2-10500.6, 10600.1, 10700.2-10700.4,
	14900.8, 14900.12, 14900.17, 15000.3, 15000.8,	10800.2-10800.6, 10900.2-10900.6, 11000.2-11000.6,
	15000.12, 15000.17, 15000.21, 15000.26, 15100.3,	11100.1, 11200.2, 11200.5, 11500.4-11500.6, 11800.2,
	15100.8, 15100.12, 15100.17, 15100.21, 15100.26,	11800.5, 11900.2-11900.4, 12000.2, 12100.2, 12200.2,
	15200.3, 15200.8, 15200.12, 15200.17, 15300.1,	12300.2-12300.14, 12400.2, 12500.3, 12600.3, 12600.6,
	15400.1, 15500.1, 15600.1, 15700.1, 15800.1, 15900.1,	12700.3, 12800.2, 12900.2, 13000.2, 13100.2, 13200.2,
	16000.1, 16100.1, 16200.1, 16300.1, 16400.1, 16500.2,	13300.2, 13400.2, 13500.2, 13600.2, 13700.2, 13800.8-
	16500.5, 18600.1, 18800.1, 18900.1, 19000.2, 19100.2,	13800.32, 13900.2-13900.22, 14100.5-14100.9, 14700.4-
	19200.2, 19300.2, 19400.2, 19600.1, 19600.8, 19600.14	14700.6, 14700.9, 14700.13-14700.15, 14700.18,
Double Notch Bend	2000.3, 7000.2, 14700.2,	14700.22-14700.24, 14700.27, 14800.4-14800.6,
	14700.11, 14700.20, 14800.2, 14800.11, 14800.20,	14800.9, 14800.13-14800.15, 14800.18, 14800.22-
	14900.2, 14900.11, 15000.2, 15000.11, 15000.20,	14800.24, 14800.27, 14900.4-14900.6, 14900.9, 14900.13-
	15100.2, 15100.11, 15100.20, 15200.2, 15200.11	14900.15, 14900.18, 15000.4-15000.6, 15000.9, 15000.13-
Dynamic Tear	2000.8, 7100.5, 7200.5, 7200.11,	15000.15, 15000.18, 15000.22-15000.24, 15000.27,
	7200.15, 7300.5, 7800.5, 7900.5, 9000.7, 9100.7,	15100.4-15100.6, 15100.9, 15100.13-15100.15, 15100.18,
	12500.5, 12600.9-12600.13, 12700.6, 12800.4, 12900.4,	15100.22-15100.24, 15100.27, 15200.4-15200.6,
	13000.4, 13100.4, 13300.4, 13400.4, 13500.4, 13600.4,	15200.9, 15200.13-15200.15, 15200.18, 15300.2,
	15300.5, 15400.5, 15500.6, 15600.5, 15700.7, 15800.7,	15400.2, 15500.2, 15600.2, 15700.3, 15800.3, 15900.3,
	15900.5, 16000.5, 16100.7, 16200.5, 16300.5, 16400.5,	16000.2, 16100.3, 16200.2, 16300.2, 16400.2, 16500.3,
	16600.6, 17000.5, 17000.10, 17200.5, 17200.10,	16500.6, 16700.2, 16700.6, 16700.9, 16700.12, 16700.15,
	17200.15, 17200.20, 17200.25, 17200.30, 17200.35,	16700.18, 16700.21, 16700.24, 16700.27, 16800.2,
	17200.40, 17200.45, 17900.5, 17900.10, 17900.15,	16800.6, 16900.2, 16900.6, 17000.2, 17000.8, 17100.2,
	17900.20, 17900.25, 17900.30, 17900.35, 17900.40,	17100.6, 17100.9, 17100.12, 17100.15, 17100.18,
	17900.45, 18000.5, 18000.10, 18100.5, 18100.10,	17200.2, 17200.8, 17200.13, 17200.18, 17200.23,
	18300.5, 18300.10, 18300.15, 18300.20, 18300.25,	17200.28, 17200.33, 17200.38, 17200.43, 17300.2,
	18300.30, 18300.35, 18300.40, 18300.45, 18600.5,	17300.6, 17300.9, 17300.12, 17300.15, 17300.18,
	18700.4, 18800.5, 18900.5, 19000.6, 19100.6, 19200.6,	17400.2, 17400.6, 17400.9, 17400.12, 17400.15,
	19300.6, 19400.6, 19500.2, 19600.5, 19600.12, 19600.20	17400.18, 17400.21, 17400.24, 17400.27, 17500.2,
Flat	13800.1-13800.2	17500.6, 17500.9, 17500.12, 17500.15, 17500.18,
Full	1100.2, 1200.2, 1300.2, 1400.2, 1500.2, 1600.2,	17600.2, 17600.6, 17700.2, 17700.6, 17700.9, 17700.12,
	1700.2, 1800.2, 1900.2, 2000.4, 2100.1-2100.3,	17700.15, 17700.18, 17700.21, 17700.24, 17700.27,
	2100.6, 2200.1-2200.3, 2200.6, 2300.1-2300.3, 2300.6,	17800.2, 17800.6, 17900.2, 17900.8, 17900.13, 17900.18,
	2400.1-2400.3, 2400.6, 2400.9, 2400.12, 2400.15,	17900.23, 17900.28, 17900.33, 17900.38, 17900.43,
	2400.18, 2500.2-2500.4, 2500.7, 2500.10, 2500.13,	18000.2, 18000.8, 18100.2, 18100.8, 18200.2, 18200.6,
	2500.16, 2600.1-2600.3, 2600.6, 2600.9, 2600.12,	18200.9, 18200.12, 18200.15, 18200.18, 18200.21,
	2600.15, 2600.18, 2700.2-2700.4, 2700.7, 2700.10,	18200.24, 18200.27, 18300.2, 18300.8, 18300.13,
	2700.13, 2700.16, 2800.3, 2800.6, 2900.3, 2900.6,	18300.18, 18300.23, 18300.28, 18300.33, 18300.38,
	3000.3, 3000.6, 3100.2-3100.10, 3200.2-3200.20,	18300.43, 18400.2, 18400.6, 18400.9, 18400.12,
	3700.2, 3800.2, 3900.2, 4000.2, 4100.2, 4200.2,	18400.15, 18400.18, 18400.21, 18400.24, 18400.27,
		18500.2, 18500.6, 18600.3, 18700.2, 18800.3, 18900.3,

- 19000.4, 19100.4, 19200.4, 19300.4, 19400.4, 19500.5,
19600.3, 19600.10, 19600.16-19600.18
- P-1** 1000.14, 1100.6, 1200.6, 1300.6, 1400.6, 1500.6,
1600.6, 1700.6, 1800.6, 1900.6, 13800.7, 14100.2
- P-2** 10600.4, 10700.7, 11100.4, 11800.4, 11900.6
- P-3** 7100.4, 7200.4, 7200.10, 10000.5, 10100.5
- Round** 2800.1-2800.2, 2900.1-2900.2, 3000.1-
3000.2, 7100.1, 7200.1, 7200.7, 14100.1, 14100.4
- SSC-276 Reference** 7100.1-7100.6
- Standard Method**
- 813** 18600.2, 18700.1, 18800.2, 18900.2, 19600.2,
19600.9, 19600.15
- ABS Sec43** 2800.3, 2800.6, 2900.3, 2900.6,
3000.3, 3000.6
- BS131H2** 14700.4-14700.6, 14700.9, 14700.13-
14700.15, 14700.18, 14700.22-14700.24, 14700.27,
14800.4-14800.6, 14800.9, 14800.13-14800.15, 14800.18,
14800.22-14800.24, 14800.27, 14900.4-14900.6,
14900.9, 14900.13-14900.15, 14900.18, 15000.4-
15000.6, 15000.9, 15000.13-15000.15, 15000.18,
15000.22-15000.24, 15000.27, 15100.4-15100.6,
15100.9, 15100.13-15100.15, 15100.18, 15100.22-
15100.24, 15100.27, 15200.4-15200.6, 15200.9, 15200.13-
15200.15, 15200.18
- BS5762** 7000.2, 13800.34-13800.37, 13900.24-
13900.26, 14200.2-14200.5, 14300.2-14300.5, 14400.2-
14400.5, 14500.2-14500.5, 14600.2-14600.5, 14700.2,
14700.11, 14700.20, 14800.2, 14800.11, 14800.20,
14900.2, 14900.11, 15000.2, 15000.11, 15000.20,
15100.2, 15100.11, 15100.20, 15200.2, 15200.11
- E 208** 1000.14, 1100.6, 1200.6, 1300.6, 1400.6,
1500.6, 1600.6, 1700.6, 1800.6, 1900.6, 2000.7,
3300.1, 3400.1, 3500.1, 3600.1, 3700.1, 3800.1,
3900.1, 4000.1, 4100.1, 4200.1, 4300.1, 4400.1,
4500.1, 4600.1, 4700.1, 4800.1, 4900.1, 5000.1,
5100.1, 5200.1, 5300.1, 5400.1, 5500.1, 5600.1,
5700.1, 5800.1, 5900.1, 6000.1, 6100.1, 6200.1,
6300.1, 7100.4, 7200.4, 7200.10, 13800.7
- E 23** 7100.2, 16500.3, 16500.6, 18600.3, 18700.2,
18800.3, 18900.3, 19000.4, 19100.4, 19200.4, 19300.4,
19400.4, 19600.3, 19600.10, 19600.16-19600.18
- E 604** 2000.8, 7100.5, 7200.5, 7200.11, 7200.15,
18600.5, 18700.4, 18800.5, 18900.5, 19000.6, 19100.6,
19200.6, 19300.6, 19400.6, 19600.5, 19600.12, 19600.20
- E 8** 7100.1, 7200.1, 7200.7, 16500.2, 16500.5,
18600.1, 18800.1, 18900.1, 19000.2, 19100.2, 19200.2,
19300.2, 19400.2, 19600.1, 19600.8, 19600.14
- E318** 12600.2
- E813** 7800.2, 7900.2, 9000.6, 9100.2, 12500.2,
12700.2, 15700.2, 15800.2, 15900.2, 16100.2, 19000.3,
19100.3, 19200.3, 19300.3, 19400.3
- JISZ3121** 14600.46-14600.47
- Standard Year**
- 1969** 1000.14, 18600.1, 18800.1, 18900.1, 19000.2,
19100.2, 19200.2, 19300.2, 19400.2, 19600.1, 19600.8,
19600.14
- 1972** 18600.3, 18700.2, 18800.3, 18900.3, 19600.3,
19600.10, 19600.16-19600.18
- 1976** 7100.5, 7200.5, 7200.11, 7200.15
- 1979** 7000.2, 14700.2, 14700.11, 14700.20, 14800.2,
14800.11, 14800.20, 14900.2, 14900.11, 15000.2,
15000.11, 15000.20, 15100.2, 15100.11, 15100.20,
15200.2, 15200.11
- 1980** 18600.5, 18700.4, 18800.5, 18900.5, 19600.5,
19600.12, 19600.20
- 1981** 16500.2-16500.6
- 1987** 7800.2, 9000.6, 9100.2, 12500.2, 12600.2,
12700.2, 15700.2, 15800.2, 15900.2, 16100.2
- Sumitomo Producer** 1000.1-1000.3, 1000.6, 1000.9,
1000.12-1000.14, 2800.1-2800.3, 2800.6, 2900.1-
2900.3, 2900.6, 3000.1-3000.3, 3000.6, 13800.1-
13800.5, 13800.34, 13900.1, 13900.24, 14000.1,
14000.4, 14100.1, 14100.4-14100.9, 14200.1, 14300.1,
14400.1, 14500.1, 14600.1
- Sumitomo Source** 1000.1-1000.3, 1000.6, 1000.9,
1000.12-1000.14, 2800.1-2800.3, 2800.6, 2900.1-
2900.3, 2900.6, 3000.1-3000.3, 3000.6, 13800.1-
13800.5, 13800.34, 13900.1, 13900.24, 14000.1,
14000.4, 14100.1, 14100.4-14100.9, 14200.1, 14300.1,
14400.1, 14500.1, 14600.1
- Surface Location wrt Surface** 14700.1, 14700.11,
14700.20, 14800.1, 14800.11, 14800.20, 14900.1,
14900.11, 15000.1, 15000.11, 15000.20, 15100.1,
15100.11, 15100.20, 15200.1, 15200.11
- SWRI Source** 7100.1, 7200.1
- T**
- T Location** 1000.1-1000.3, 1000.9, 1000.12-1000.14
- T Lot ID** 4700.1-4700.3
- Tensile Test Type** 1000.1-1000.2, 1100.1, 1200.1,
1300.1, 1400.1, 1500.1, 1600.1, 1700.1, 1800.1,
1900.1, 2000.1, 2100.1-2100.2, 2200.1-2200.2, 2300.1-
2300.2, 2400.1-2400.2, 2600.1-2600.2, 2800.1-2800.2,
2900.1-2900.2, 3000.1-3000.2, 3100.1, 7000.1, 7100.1,
7200.1, 7200.7, 7300.1, 7400.1, 7600.1, 7800.1,
7900.1, 9000.1, 9100.1, 9200.1, 9400.1, 9500.1,
9500.4, 9600.1, 9600.4, 9600.7, 9700.1, 9700.4,
9800.1, 9900.1, 9900.4, 10000.1, 10100.1, 10200.1,
10300.1, 10300.4, 10400.1, 10500.1, 10700.1, 10800.1,
10900.1, 11000.1, 11200.1, 11200.4, 11300.1, 11400.1,
11500.1, 11600.1, 11700.1, 11700.4, 11800.1, 11900.1,
12000.1, 12100.1, 12200.1, 12300.1, 12400.1, 12500.1;
12600.1, 12700.1, 12800.1, 12900.1, 13000.1, 13100.1,
13200.1, 13300.1, 13400.1, 13500.1, 13600.1, 13700.1,
13800.1-13800.2, 14100.1, 14100.4, 14500.46-14500.47,
14600.46-14600.47, 14700.3, 14700.8, 14700.12,

345

14700.17, 14700.21, 14700.26, 14800.3, 14800.8,
 14800.12, 14800.17, 14800.21, 14800.26, 14900.3,
 14900.8, 14900.12, 14900.17, 15000.3, 15000.8,
 15000.12, 15000.17, 15000.21, 15000.26, 15100.3,
 15100.8, 15100.12, 15100.17, 15100.21, 15100.26,
 15200.3, 15200.8, 15200.12, 15200.17, 15300.1,
 15400.1, 15500.1, 15600.1, 15700.1, 15800.1, 15900.1,
 16000.1, 16100.1, 16200.1, 16300.1, 16400.1, 16500.2,
 16500.5, 16600.5, 16700.1, 16700.5, 16700.8, 16700.11,
 16700.14, 16700.17, 16700.20, 16700.23, 16700.26,
 16800.1, 16800.5, 16900.1, 16900.5, 17000.1, 17000.7,
 17100.1, 17100.5, 17100.8, 17100.11, 17100.14,
 17100.17, 17200.1, 17200.7, 17200.12, 17200.17,
 17200.22, 17200.27, 17200.32, 17200.37, 17200.42,
 17300.1, 17300.5, 17300.8, 17300.11, 17300.14,
 17300.17, 17400.1, 17400.5, 17400.8, 17400.11,
 17400.14, 17400.17, 17400.20, 17400.23, 17400.26,
 17500.1, 17500.5, 17500.8, 17500.11, 17500.14,
 17500.17, 17600.1, 17600.5, 17700.1, 17700.5, 17700.8,
 17700.11, 17700.14, 17700.17, 17700.20, 17700.23,
 17700.26, 17800.1, 17800.5, 17900.1, 17900.7, 17900.12,
 17900.17, 17900.22, 17900.27, 17900.32, 17900.37,
 17900.42, 18000.1, 18000.7, 18100.1, 18100.7, 18200.1,
 18200.5, 18200.8, 18200.11, 18200.14, 18200.17,
 18200.20, 18200.23, 18200.26, 18300.1, 18300.7,
 18300.12, 18300.17, 18300.22, 18300.27, 18300.32,
 18300.37, 18300.42, 18400.1, 18400.5, 18400.8,
 18400.11, 18400.14, 18400.17, 18400.20, 18400.23,
 18400.26, 18500.1, 18500.5, 18600.1, 18800.1, 18900.1,
 19000.2, 19100.2, 19200.2, 19300.2, 19400.2, 19500.1,
 19600.1, 19600.8, 19600.14

Test Type

Charpy V Impact 1000.3, 1000.6, 1000.9,
 1000.12, 1100.2, 1200.2, 1300.2, 1400.2, 1500.2,
 1600.2, 1700.2, 1800.2, 1900.2, 2000.4, 2100.3,
 2100.6, 2200.3, 2200.6, 2300.3, 2300.6, 2400.3,
 2400.6, 2400.9, 2400.12, 2400.15, 2400.18, 2500.2-
 2500.4, 2500.7, 2500.10, 2500.13, 2500.16, 2600.3,
 2600.6, 2600.9, 2600.12, 2600.15, 2600.18, 2700.2-
 2700.4, 2700.7, 2700.10, 2700.13, 2700.16, 2800.3,
 2800.6, 2900.3, 2900.6, 3000.3, 3000.6, 3100.2-
 3100.10, 3200.2-3200.20, 3300.2, 3400.2, 3500.2,
 3600.2, 3700.2, 3800.2, 3900.2, 4000.2, 4100.2,
 4200.2, 4300.2, 4400.2, 4500.2, 4600.2, 4700.2,
 4800.2, 4900.2, 5000.2, 5100.2, 5200.2, 5300.2,
 5400.2, 5500.2, 5600.2, 5700.2, 5800.2, 5900.2,
 6000.2, 6100.2, 6200.2, 6300.2, 6400.1, 6400.4,
 6400.7, 6400.10, 6400.13, 6400.16, 6400.19-6400.21,
 6500.2-6500.4, 6600.2-6600.4, 6700.2-6700.4, 6800.2-
 6800.4, 6900.1, 7000.5, 7100.2, 7200.2, 7200.8,
 7200.13, 7300.2, 7400.2-7400.10, 7500.2-7500.20,
 7600.2-7600.20, 7700.2-7700.20, 7800.3, 7900.3,
 8000.2-8000.4, 8100.2-8100.4, 8200.2-8200.4, 8300.2-

8300.4, 8400.1, 8500.2-8500.4, 8600.2-8600.4, 8700.2-
 8700.4, 8800.2-8800.4, 8900.1, 9000.2, 9100.3,
 9200.2-9200.20, 9300.2-9300.20, 9400.2, 9500.2,
 9500.5, 9600.2, 9600.5, 9700.2, 9700.5-9700.9,
 9800.2, 9900.2, 9900.5-9900.9, 10000.2, 10100.2,
 10200.2-10200.10, 10300.2, 10300.5, 10400.2, 10500.2-
 10500.6, 10600.1, 10700.2-10700.4, 10800.2-10800.6,
 10900.2-10900.6, 11000.2-11000.6, 11100.1, 11200.2,
 11200.5, 11300.2, 11400.2, 11500.2-11500.6, 11600.2,
 11700.2, 11700.5, 11800.2, 11800.5, 11900.2-11900.4,
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 13000.2, 13100.2, 13200.2, 13300.2, 13400.2, 13500.2,
 13600.2, 13700.2, 13800.3-13800.5, 13800.8-13800.32,
 13900.2-13900.22, 14000.4-14000.22, 14100.5-14100.9,
 14200.6-14200.48, 14300.6-14300.48, 14400.6-14400.48,
 14500.6-14500.44, 14600.6-14600.44, 14700.4-14700.6,
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 14700.24, 14700.27, 14800.4-14800.6, 14800.9, 14800.13-
 14800.15, 14800.18, 14800.22-14800.24, 14800.27,
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 15000.22-15000.24, 15000.27, 15100.4-15100.6,
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 15100.24, 15100.27, 15200.4-15200.6, 15200.9, 15200.13-
 15200.15, 15200.18, 15300.2, 15400.2, 15500.2,
 15600.2, 15700.3, 15800.3, 15900.3, 16000.2, 16100.3,
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 16700.2, 16700.6, 16700.9, 16700.12, 16700.15,
 16700.18, 16700.21, 16700.24, 16700.27, 16800.2,
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 17500.6, 17500.9, 17500.12, 17500.15, 17500.18,
 17600.2, 17600.6, 17700.2, 17700.6, 17700.9, 17700.12,
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 17800.2, 17800.6, 17900.2, 17900.8, 17900.13, 17900.18,
 17900.23, 17900.28, 17900.33, 17900.38, 17900.43,
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 19000.4, 19100.4, 19200.4, 19300.4, 19400.4, 19500.5,
 19600.3, 19600.10, 19600.16-19600.18

Dynamic Tear 2000.8, 7100.5, 7200.5, 7200.11,
 7200.15, 7300.5, 7800.5, 7900.5, 9000.7, 9100.7,



- 12500.5, 12600.9-12600.13, 12700.6, 12800.4, 12900.4,
13000.4, 13100.4, 13300.4, 13400.4, 13500.4, 13600.4,
15300.5, 15400.5, 15500.6, 15600.5, 15700.7, 15800.7,
15900.5, 16000.5, 16100.7, 16200.5, 16300.5, 16400.5,
16600.6, 17000.5, 17000.10, 17200.5, 17200.10,
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17200.40, 17200.45, 17900.5, 17900.10, 17900.15,
17900.20, 17900.25, 17900.30, 17900.35, 17900.40,
17900.45, 18000.5, 18000.10, 18100.5, 18100.10,
18300.5, 18300.10, 18300.15, 18300.20, 18300.25,
18300.30, 18300.35, 18300.40, 18300.45, 18600.5,
18700.4, 18800.5, 18900.5, 19000.6, 19100.6, 19200.6,
19300.6, 19400.6, 19500.2, 19600.5, 19600.12, 19600.20
- Fracture Toughness** 2000.3, 7000.2, 7800.2,
7900.2, 9000.6, 9100.2, 12500.2, 12600.2, 12700.2,
13800.34-13800.37, 13900.24-13900.26, 14000.2-
14000.3, 14100.3, 14200.2-14200.5, 14300.2-14300.5,
14400.2-14400.5, 14500.2-14500.5, 14600.2-14600.5,
14700.2, 14700.11, 14700.20, 14800.2, 14800.11,
14800.20, 14900.2, 14900.11, 15000.2, 15000.11,
15000.20, 15100.2, 15100.11, 15100.20, 15200.2,
15200.11, 15700.2, 15800.2, 15900.2, 16100.2, 16600.1,
18600.2, 18700.1, 18800.2, 18900.2, 19000.3, 19100.3,
19200.3, 19300.3, 19400.3, 19600.2, 19600.9, 19600.15
- Nil Ductility Transition** 1000.14, 1100.6,
1200.6, 1300.6, 1400.6, 1500.6, 1600.6, 1700.6,
1800.6, 1900.6, 2000.7, 3300.1, 3400.1, 3500.1,
3600.1, 3700.1, 3800.1, 3900.1, 4000.1, 4100.1,
4200.1, 4300.1, 4400.1, 4500.1, 4600.1, 4700.1,
4800.1, 4900.1, 5000.1, 5100.1, 5200.1, 5300.1,
5400.1, 5500.1, 5600.1, 5700.1, 5800.1, 5900.1,
6000.1, 6100.1, 6200.1, 6300.1, 7100.4, 7200.4,
7200.10, 10000.5, 10100.5, 10600.4, 10700.7, 11100.4,
11800.4, 11900.6, 13800.7, 14100.2
- Tensile** 1000.1-1000.2, 1100.1, 1200.1, 1300.1,
1400.1, 1500.1, 1600.1, 1700.1, 1800.1, 1900.1,
2000.1, 2100.1-2100.2, 2200.1-2200.2, 2300.1-2300.2,
2400.1-2400.2, 2600.1-2600.2, 2800.1-2800.2, 2900.1-
2900.2, 3000.1-3000.2, 3100.1, 7000.1, 7100.1,
7200.1, 7200.7, 7300.1, 7400.1, 7600.1, 7800.1,
7900.1, 9000.1, 9100.1, 9200.1, 9400.1, 9500.1,
9500.4, 9600.1, 9600.4, 9600.7, 9700.1, 9700.4,
9800.1, 9900.1, 9900.4, 10000.1, 10100.1, 10200.1,
10300.1, 10300.4, 10400.1, 10500.1, 10700.1, 10800.1,
10900.1, 11000.1, 11200.1, 11200.4, 11300.1, 11400.1,
11500.1, 11600.1, 11700.1, 11700.4, 11800.1, 11900.1,
12000.1, 12100.1, 12200.1, 12300.1, 12400.1, 12500.1,
12600.1, 12700.1, 12800.1, 12900.1, 13000.1, 13100.1,
13200.1, 13300.1, 13400.1, 13500.1, 13600.1, 13700.1,
13800.1-13800.2, 14100.1, 14100.4, 14500.46-14500.47,
14600.46-14600.47, 14700.3, 14700.8, 14700.12,
14700.17, 14700.21, 14700.26, 14800.3, 14800.8,
14800.12, 14800.17, 14800.21, 14800.26, 14900.3,
14900.8, 14900.12, 14900.17, 15000.3, 15000.8,
15000.12, 15000.17, 15000.21, 15000.26, 15100.3,
15100.8, 15100.12, 15100.17, 15100.21, 15100.26,
15200.3, 15200.8, 15200.12, 15200.17, 15300.1,
15400.1, 15500.1, 15600.1, 15700.1, 15800.1, 15900.1,
16000.1, 16100.1, 16200.1, 16300.1, 16400.1, 16500.2,
16500.5, 16600.5, 16700.1, 16700.5, 16700.8, 16700.11,
16700.14, 16700.17, 16700.20, 16700.23, 16700.26,
16800.1, 16800.5, 16900.1, 16900.5, 17000.1, 17000.7,
17100.1, 17100.5, 17100.8, 17100.11, 17100.14,
17100.17, 17200.1, 17200.7, 17200.12, 17200.17,
17200.22, 17200.27, 17200.32, 17200.37, 17200.42,
17300.1, 17300.5, 17300.8, 17300.11, 17300.14,
17300.17, 17400.1, 17400.5, 17400.8, 17400.11,
17400.14, 17400.17, 17400.20, 17400.23, 17400.26,
17500.1, 17500.5, 17500.8, 17500.11, 17500.14,
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17700.11, 17700.14, 17700.17, 17700.20, 17700.23,
17700.26, 17800.1, 17800.5, 17900.1, 17900.7, 17900.12,
17900.17, 17900.22, 17900.27, 17900.32, 17900.37,
17900.42, 18000.1, 18000.7, 18100.1, 18100.7, 18200.1,
18200.5, 18200.8, 18200.11, 18200.14, 18200.17,
18200.20, 18200.23, 18200.26, 18300.1, 18300.7,
18300.12, 18300.17, 18300.22, 18300.27, 18300.32,
18300.37, 18300.42, 18400.1, 18400.5, 18400.8,
18400.11, 18400.14, 18400.17, 18400.20, 18400.23,
18400.26, 18500.1, 18500.5, 18600.1, 18800.1, 18900.1,
19000.2, 19100.2, 19200.2, 19300.2, 19400.2, 19500.1,
19600.1, 19600.8, 19600.14
- Top Composition Position** 2100.1-2100.5, 2200.1-
2200.5, 2300.1-2300.8, 2400.1-2400.5, 2400.9-2400.11,
2400.15-2400.17, 2500.1-2500.18, 2600.1-2600.5,
2600.9-2600.11, 2600.15-2600.17, 2700.1-2700.18,
2800.1-2800.5, 2900.1-2900.5, 3000.1-3000.5
- Top Ingot Position** 2100.1-2100.3, 2200.1-2200.3,
2300.1-2300.3, 2400.1-2400.3, 2400.9, 2400.15,
2500.1, 2600.1-2600.3, 2600.9, 2600.15, 2700.1,
16700.1, 16800.1, 16900.1, 17000.1, 17100.1, 17200.1,
17300.1, 17400.1, 17500.1, 17600.1, 17700.1, 17800.1,
17900.1, 18000.1, 18100.1, 18200.1, 18300.1, 18400.1,
18500.1
- Transverse Location wrt Weld** 14500.46-
14500.47, 14600.46-14600.47
- TSAW Weld Type** 14000.1-14000.22, 14400.1-
14400.48, 14600.1-14600.47
- TW8544 Filler Name** 6400.16, 6400.19-6400.21,
6700.1, 6700.4, 6800.1, 6800.4, 8300.1, 8300.4,
8500.1, 8500.4, 8800.1, 8800.4
- U**
- U Groove Joint Preparation** 2500.1, 2500.4,
2500.7, 2500.10, 2500.13, 2500.16, 2700.1, 2700.4,
2700.7, 2700.10, 2700.13, 2700.16

Un Kansas Source 7000.1
US Steel Producer 3100.1, 3200.1, 6500.1, 6600.1, 6700.1, 6800.1, 6900.1, 7000.1, 7400.1, 7500.1, 7600.1, 7700.1, 8000.1, 8100.1, 8200.1, 8300.1, 8400.1, 8500.1, 9200.1, 9300.1
US Steel Source 3100.1, 3200.1, 7400.1, 7500.1, 7600.1, 7700.1, 9200.1, 9300.1
US-43 Flux Name 2500.1, 2500.4, 2500.7, 2500.10, 2500.13, 2500.16, 2700.1, 2700.4, 2700.7, 2700.10, 2700.13, 2700.16
USN 6/9 Reference 18600.1-18600.6, 18700.1-18700.5, 18800.1-18800.6, 18900.1-18900.6, 19000.1-19000.7, 19100.1-19100.7, 19200.1-19200.7, 19300.1-19300.7, 19400.1-19400.7, 19600.1-19600.21
USN 9/9 Reference 12800.1-12800.5, 12900.1-12900.5, 13000.1-13000.5, 13100.1-13100.5, 13200.1-13200.3, 13300.1-13300.5, 13400.1-13400.5, 13500.1-13500.5, 13600.1-13600.5, 13700.1-13700.3
USN Source 12800.1, 12900.1, 13000.1, 13100.1, 13200.1, 13300.1, 13400.1, 13500.1, 13600.1, 13700.1, 18600.1, 18700.1, 18800.1, 18900.1, 19000.1, 19100.1, 19200.1, 19300.1, 19400.1, 19600.1, 19600.7
USN-1 Reference 16700.1-16700.28, 16800.1-16800.7, 16900.1-16900.7, 17000.1-17000.11, 17100.1-17100.19, 17200.1-17200.46, 17300.1-17300.19, 17400.1-17400.28, 17500.1-17500.19, 17600.1-17600.7, 17700.1-17700.28, 17800.1-17800.7, 17900.1-17900.46, 18000.1-18000.11, 18100.1-18100.11, 18200.1-18200.28, 18300.1-18300.46, 18400.1-18400.28, 18500.1-18500.7

V

V Groove Joint Preparation 3200.1, 3200.4-3200.20, 7500.1, 7500.4-7500.20, 7700.1, 7700.4-7700.20, 9700.7-9700.9, 9900.7-9900.9, 10200.8-10200.10, 14700.1-14700.3, 14700.6-14700.8, 14700.11-14700.12, 14700.15-14700.17, 14700.20-14700.21, 14700.24-14700.26, 14800.1-14800.3, 14800.6-14800.8, 14800.11-14800.12, 14800.15-14800.17, 14800.20-14800.21, 14800.24-14800.26, 14900.1-14900.3, 14900.6-14900.8, 14900.11-14900.12, 14900.15-14900.17, 15000.1-15000.3, 15000.6-15000.8, 15000.11-15000.12, 15000.15-15000.17, 15000.20-15000.21, 15000.24-15000.26, 15100.1-15100.3, 15100.6-15100.8, 15100.11-15100.12, 15100.15-15100.17, 15100.20-15100.21, 15100.24-15100.26, 15200.1-15200.3, 15200.6-15200.8, 15200.11-15200.12, 15200.15-15200.17
Vertical Welding Position 6400.4, 6400.7, 6400.10, 6400.13, 6400.16, 6400.19-6400.21, 6500.1, 6500.4, 6600.1, 6600.4, 6700.1, 6700.4, 6800.1, 6800.4, 8000.1, 8000.4, 8100.1, 8100.4, 8200.1, 8200.4, 8300.1, 8300.4, 8500.1, 8500.4, 8600.1, 8600.4, 8700.1, 8700.4, 8800.1, 8800.4

Vert-Up Welding Position 10500.4-10500.6, 12300.8-12300.14

W

W Final Processing 19000.1, 19100.1, 19200.1, 19300.1, 19400.1
W Heat Treatment 19000.1, 19100.1, 19200.1, 19300.1, 19400.1
W36 Filler Name 13900.1, 13900.4-13900.26, 14000.1-14000.22, 14300.1-14300.48, 14400.1-14400.48, 14500.1-14500.47, 14600.1-14600.47

Weld Type

ESW 6400.4, 6400.7, 6500.1, 6500.4, 8000.1, 8000.4, 8600.1, 8600.4
FCA 14700.1-14700.3, 14700.6-14700.8, 14700.11-14700.12, 14700.15-14700.17, 14700.20-14700.21, 14700.24-14700.26, 14800.1-14800.3, 14800.6-14800.8, 14800.11-14800.12, 14800.15-14800.17, 14800.20-14800.21, 14800.24-14800.26, 14900.1-14900.3, 14900.6-14900.8, 14900.11-14900.12, 14900.15-14900.17, 15000.1-15000.3, 15000.6-15000.8, 15000.11-15000.12, 15000.15-15000.17, 15000.20-15000.21, 15000.24-15000.26, 15100.1-15100.3, 15100.6-15100.8, 15100.11-15100.12, 15100.15-15100.17, 15100.20-15100.21, 15100.24-15100.26, 15200.1-15200.3, 15200.6-15200.8, 15200.11-15200.12, 15200.15-15200.17
NGESW 6400.10, 6400.13, 6400.16, 6400.19-6400.21, 6600.1, 6600.4, 6700.1, 6700.4, 6800.1, 6800.4, 8100.1, 8100.4, 8200.1, 8200.4, 8300.1, 8300.4, 8500.1, 8500.4, 8700.1, 8700.4, 8800.1, 8800.4
SAW 2500.1, 2500.4, 2500.7, 2500.10, 2500.13, 2500.16, 2700.1, 2700.4, 2700.7, 2700.10, 2700.13, 2700.16, 3200.1, 3200.4-3200.20, 7200.7-7200.8, 7200.13, 7500.1, 7500.4-7500.20, 7700.1, 7700.4-7700.20, 9300.1, 9300.4-9300.20, 10200.4-10200.6, 10800.4-10800.6, 10900.4-10900.6, 11000.4-11000.6, 11500.4-11500.6, 12300.4-12300.6, 13900.1, 13900.4-13900.26, 14300.1-14300.48, 14500.1-14500.47
SMA 3100.2-3100.10, 7400.2-7400.10, 7600.2-7600.20, 9200.2-9200.20, 13800.8-13800.36, 14200.1-14200.48, 16500.1, 16500.5, 19000.1, 19100.1, 19200.1, 19300.1, 19400.1, 19600.7, 19600.14
SMAW 9700.7-9700.9, 10200.8-10200.10, 10500.4-10500.6, 12300.8-12300.14
SMAW/SAW 9900.7-9900.9
TSAW 14000.1-14000.22, 14400.1-14400.48, 14600.1-14600.47
Welding Position
1G 14800.11-14800.12, 14800.15-14800.17
2G 14700.11-14700.12, 14700.15-14700.17, 14800.20-14800.21, 14800.24-14800.26

3G 14700.20-14700.21, 14700.24-14700.26, 14900.1-14900.3, 14900.6-14900.8, 15000.20-15000.21, 15000.24-15000.26, 15100.1-15100.3, 15100.6-15100.8, 15100.20-15100.21, 15100.24-15100.26, 15200.11-15200.12, 15200.15-15200.17

4G 14800.1-14800.3, 14800.6-14800.8, 14900.11-14900.12, 14900.15-14900.17

Downhand 7200.7-7200.8, 7200.13, 13800.8-13800.36, 13900.1, 13900.4-13900.26, 14000.1-14000.22, 16500.1, 16500.5, 19000.1, 19100.1, 19200.1, 19300.1, 19400.1, 19600.7, 19600.14

Downhand IG 2500.1, 2500.4, 2500.7, 2500.10, 2500.13, 2500.16, 2700.1, 2700.4, 2700.7, 2700.10, 2700.13, 2700.16, 3100.2-3100.10, 3200.1, 3200.4-3200.20, 7400.2-7400.10, 7500.1, 7500.4-7500.20, 14200.1-14200.48, 14300.1-14300.48, 14400.1-14400.48, 14500.1-14500.47, 14600.1-14600.47

Flat 9700.7-9700.9, 9900.7-9900.9, 10200.4-10200.10, 10800.4-10800.6, 10900.4-10900.6, 11000.4-11000.6, 11500.4-11500.6, 12300.4-12300.6

IG 7600.2-7600.20, 7700.1, 7700.4-7700.20, 9200.2-9200.20, 9300.1, 9300.4-9300.20, 14700.1-14700.3, 14700.6-14700.8, 15000.1-15000.3, 15000.6-15000.8, 15000.11-15000.12, 15000.15-15000.17, 15100.11-15100.12, 15100.15-15100.17, 15200.1-15200.3, 15200.6-15200.8

Vertical 6400.4, 6400.7, 6400.10, 6400.13, 6400.16, 6400.19-6400.21, 6500.1, 6500.4, 6600.1, 6600.4, 6700.1, 6700.4, 6800.1, 6800.4, 8000.1, 8000.4, 8100.1, 8100.4, 8200.1, 8200.4, 8300.1, 8300.4, 8500.1, 8500.4, 8600.1, 8600.4, 8700.1, 8700.4, 8800.1, 8800.4

Vert-Up 10500.4-10500.6, 12300.8-12300.14

WJ,3/87 Reference 16500.1-16500.7

WJ,7/87 Reference 14700.1-14700.28, 14800.1-14800.28, 14900.1-14900.19, 15000.1-15000.28, 15100.1-15100.28, 15200.1-15200.19

Y

Year Produced

1971 1000.1-1000.3, 1000.6, 1000.9, 1000.12-1000.14

1972 2100.1-2100.3, 2100.6, 2200.1-2200.3, 2200.6, 2300.1-2300.3, 2400.1-2400.3, 2400.6, 2400.9, 2400.12, 2400.15, 2400.18, 2500.1, 2600.1-2600.3, 2600.6, 2600.9, 2600.12, 2600.15, 2600.18, 2700.1, 2800.1-2800.3, 2800.6, 2900.1-2900.3, 2900.6, 3000.1-3000.3, 3000.6

1976 15300.1, 15400.1, 16000.1, 16200.1

1977 16100.1, 16600.1

1978 7300.1, 15500.1, 15600.1, 15900.1

1979 1100.1, 1200.1, 1300.1, 1400.1, 1500.1, 1600.1, 1700.1, 1800.1, 1900.1, 15700.1, 15800.1,

16300.1, 16400.1

1980 9000.1, 9100.1

1981 17400.1, 17400.11, 17400.20

1982 12600.1, 16700.1, 16700.11, 16700.20, 16800.1, 16800.5, 16900.1, 16900.5, 17000.1, 17000.7, 17100.1, 17100.11, 17200.1, 17200.17, 17200.32, 17300.1, 17300.11, 17500.1, 17500.11, 17600.1, 17600.5, 17700.1, 17700.11, 17700.20, 17800.1, 17800.5, 17900.1, 17900.17, 17900.32, 18000.1, 18000.7, 18100.1, 18100.7, 18200.1, 18200.11, 18200.20, 18300.1, 18300.17, 18300.32, 18400.1, 18400.11, 18400.20, 18500.1, 18500.5, 19500.1

1983 7800.1, 7900.1

1984 12500.1, 12700.1

Yes Did Specimen Fracture? 1100.2, 1200.2, 1300.2, 1400.2, 1500.2, 1600.2, 1700.2, 1800.2, 1900.2, 2000.4, 2200.6, 2900.3, 2900.6, 3300.2, 3400.2, 3500.2, 3600.2, 3700.2, 3800.2, 3900.2, 4000.2, 4100.2, 4200.2, 4300.2, 4400.2, 4500.2, 4600.2, 4700.2, 4800.2, 4900.2, 5000.2, 5100.2, 5200.2, 5300.2, 5400.2, 5500.2, 5600.2, 5700.2, 5800.2, 5900.2, 6000.2, 6100.2, 6200.2, 6300.2, 6400.1, 6400.4, 6400.7, 6400.10, 6400.13, 6400.16, 6400.19-6400.21, 6500.2-6500.4, 6600.2-6600.4, 6700.2-6700.4, 6800.2-6800.4, 6900.1, 8000.2-8000.4, 8100.2-8100.4, 8200.2-8200.4, 8300.2-8300.4, 8400.1, 8500.2-8500.4, 8600.2-8600.4, 8700.2-8700.4, 8800.2-8800.4, 8900.1, 14100.5-14100.9

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