

SUMMARY OF FRACTURE TOUGHNESS 304-0-1

Specimen Type: CT SS304 Material: Drawing No.: Fig. 2 RT Temperature: Relative Humidity: 51%

element

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer

Material Properties Yield (ksi) Tensile (ksi) Modulus (Msi)	40 90 27		ASTM E1820-20 Standard Test
Specimen Dimensions Thickness (in) Net Thickness (in) Width (in) Pin Spacing (in)	0.5 0.4 1 0.55	Notch Depth (in) 0.400 Gage Length (in) 0.300 Alpha Ratio 1.25	3000 Specimen 304-0-1 JIC Result, lbf- 729.98
<u>Precrack Parameters</u> Pmax (lbf) Final a (in) Pf (lbf)	397 0.5379 1093.9	Stress Ratio 0.1 Kmax (ksi sqrt (in)) 8.7	2000
Initial measured crack lengths (in 0.533 0.534	0.534 0.540	0.537 0.537 0.541 0.542 0.542	Z ij 1500
Final measured crack lengths (in) 0.702 0.702	0.709 0.716	0.731 0.737 0.739 0.751 0.753	, libration of the state of the
Ave. initial crack length (in) Ave. final crack length (in) Delta a measured (in) Delta a predicted (in)	0.5379 0.7265 0.1886 0.068	aoq (in) 0.532 Compliance Adj. Factor 0.821 Effective Modulus (Msi) 22.2	1000
Results JQ (E1820) KJIC(E**JQ)^1/2	730.0 lbf-in/in/2 147.2 ksi sqrt(in)		500
Qualification of Data 7.4.2: precrack length 9.1.4.1; precrack 9.1.4.2; final crack 9.1.5.1; Da meas	valid valid valid valid	Qualification of JQ as JIC A9.10.1; thickness valid A9.10.2; ligament valid A9.11; slope valid	0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 crack extension, in
9.1.5.2; Da pred A9.6.4; # of pnts in reg.A A9.6.4; # of pnts in reg.B A9.9.1; C2<1	invalid valid valid valid		All results are reported For Information Only Applicable Specification: ASTM E1820-20

Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys;

EPRI Task ID: 1-110095-01-02;

Approved for release by:

Tim Esau, Quality Manager

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A9.9.2.1; a0q-a0

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

valid

valid

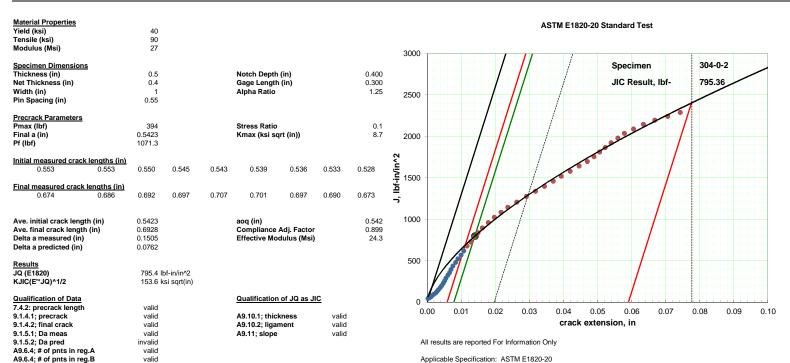
valid

valid



SUMMARY OF FRACTURE TOUGHNESS 304-0-2

Requestor: Wall Specimen Type: CT Company: Electric Power Material: SS304 Research Institute Drawing No.: Fig. 2 P.O. No.: 4700007062 Job No.: 02039-011217 Temperature RŤ 51% Machining Source: Customer Relative Humidity:



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EPRI Task ID: 1-110095-01-02;

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A9.9.1: C2<1

A9.9.2.1; a0q-a0

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

valid

valid

valid

valid

valid

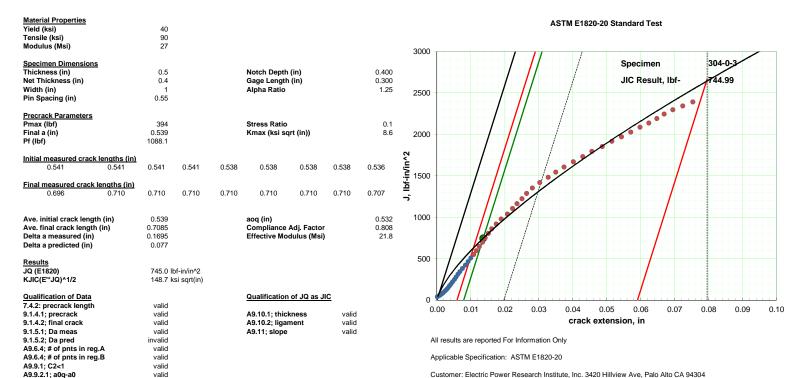
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Element Materials Technology 3701 Port Union Road Fairfield OH 45014, USA

P 513 984 4112 F 513 984 8258 T 888 786 7555 info.cincinnati@element.com element.com

SUMMARY OF FRACTURE TOUGHNESS 304-0-3

Requestor: Wall Specimen Type: CT Company: Electric Power SS304 Research Institute Drawing No.: Fig. 2 P.O. No.: 4700007062 Job No.: 02039-011217 Temperature RŤ 51% Machining Source: Customer Relative Humidity:



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Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys;

EPRI Task ID: 1-110095-01-02;

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A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

valid

valid

valid

element

Material:

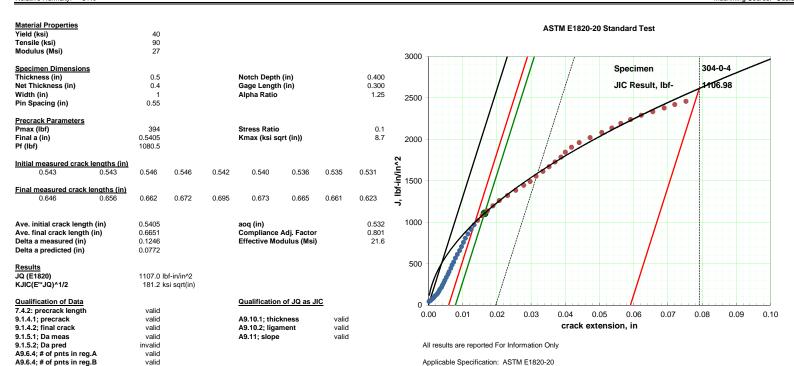


SUMMARY OF FRACTURE TOUGHNESS 304-0-4

Specimen Type: CT Material: SS304 Drawing No.: Fig. 2 Temperature RŤ 51% Relative Humidity:

element

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer



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Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

EPRI Task ID: 1-110095-01-02;

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys;

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A9.9.1: C2<1

A9.9.2.1; a0q-a0

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

valid

valid

valid

valid

valid



Element Materials Technology Fairfield OH 45014, USA

Machining Source: Customer

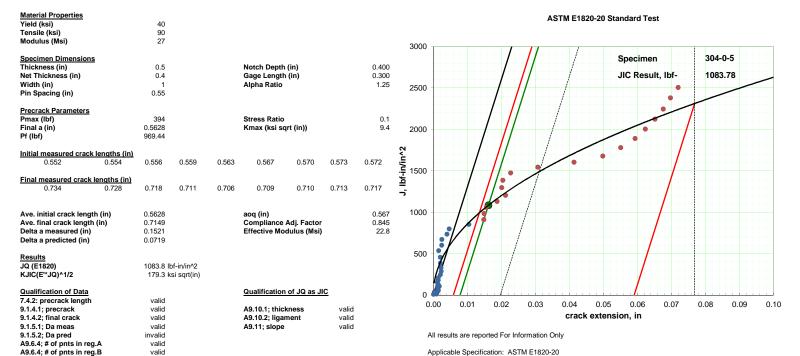
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SUMMARY OF FRACTURE TOUGHNESS 304-0-5

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217

Specimen Type: CT Material: SS304 Drawing No.: Fig. 2 Temperature RŤ 51% Relative Humidity:

element



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Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

EPRI Task ID: 1-110095-01-02;

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys;

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A9.9.1: C2<1

A9.9.2.1; a0q-a0

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

valid

valid

valid

valid

valid



SUMMARY OF FRACTURE TOUGHNESS 304-20-1

Specimen Type: CT Material: SS304 Drawing No.: Fig. 2 Temperature RŤ

valid

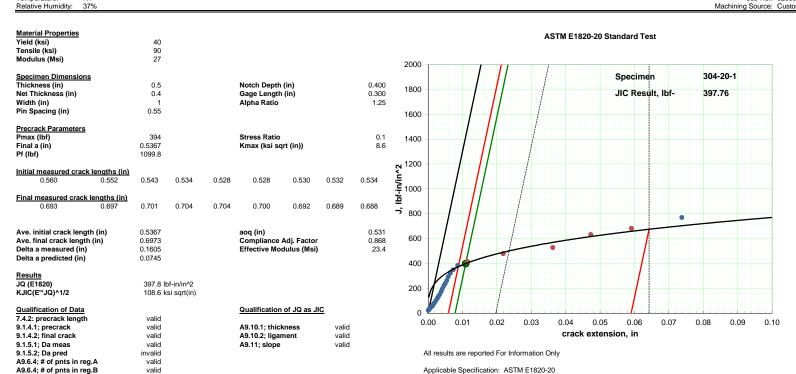
valid

valid

valid

invalid

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer



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A9.9.1: C2<1

A9.9.2.1; a0q-a0

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

element



SUMMARY OF FRACTURE TOUGHNESS 304-20-2

Specimen Type: CT SS304 Material: Drawing No.: Fig. 2 RT Temperature: Relative Humidity: 37%

element

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer

Material Properties Yield (ksi) Tensile (ksi) Modulus (Msi)		40 90 27							2000 -			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Α,	STM E18	20-20 Star	ndard Tes	st			
Specimen Dimensions Thickness (in) Net Thickness (in) Width (in) Pin Spacing (in)		0.5 0.4 1 0.55			Notch Depth Gage Length Alpha Ratio			0.400 0.300 1.25	1800 - 1600 -			$\ \cdot\ $				Specime IIC Resu		304-2 410.0		
Precrack Parameters Pmax (lbf) Final a (in) Pf (lbf)		417 0.5289 1140.9			Stress Ratio Kmax (ksi so	ırt (in))		0.1 8.8	1400 - N											
Initial measured crack I 0.547 Final measured crack Ie 0.767	0.538	0.527 0.785	0.521	0.520 0.789	0.522	0.527 0.791	0.534	0.535	J. 1000 -		//									
Ave. initial crack length Ave. final crack length (Delta a measured (in) Delta a predicted (in)		0.5289 0.7867 0.2578 0.0542			aoq (in) Compliance Effective Mo			0.525 0.837 22.6	600 -											
Results JQ (E1820) KJIC(E**JQ)^1/2 Qualification of Data			of-in/in^2 si sqrt(in)		Qualification	of JQ as JI	C		200 -											
7.4.2: precrack length 9.1.4.1; precrack 9.1.4.2; final crack 9.1.5.1; Da meas 9.1.5.2; Da pred		valid valid valid valid invalid			A9.10.1; thic A9.10.2; ligal A9.11; slope		valid valid valid			00 Ill resul	0.01	0.02	0.03		0.05 extension	0.06 on, in	0.07	0.08	0.09	0.10

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EPRI Task ID: 1-110095-01-02;

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys;

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A9.6.4; # of pnts in reg.A

A9.6.4; # of pnts in reg.B

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

A9.9.1; C2<1

A9.9.2.1; a0q-a0

valid

valid

valid

valid

valid

valid

invalid

Applicable Specification: ASTM E1820-20



SUMMARY OF FRACTURE TOUGHNESS 304-20-3

Specimen Type: CT SS304 Material: Drawing No.: Fig. 2 RT Temperature: Relative Humidity: 37%

element

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer

Material Properties Yield (ksi) Tensile (ksi) Modulus (Msi)		40 90 27							2000	0			Δ	STM E18	320-20 Sta	ındard Te	st			
Specimen Dimensions Thickness (in)	<u> </u>	0.5			Notch Depth	(in)		0.400				/	/			Specime	n	304-	20-3	
Net Thickness (in)		0.4			Gage Length			0.300	180	0	- 1	- 11	- /			JIC Resu	lt, lbf-	380.	77	
Width (in)		1			Alpha Ratio			1.25			- 1	- 11	- 1							
Pin Spacing (in)		0.55							1600	0	- 1	H	/							
Precrack Parameters											- 1	H	/							
Pmax (lbf) Final a (in)		394 0.5408			Stress Ratio Kmax (ksi so			0.1 8.7	1400	0	- 1	H	- /							
Pf (lbf)		1079			Killax (KSI SC	irt (in))		0.7				H	1							
11 (161)		1075							120	0	- / -	H	/							
Initial measured crack									<u>}</u>		- /		/							
0.573	0.565	0.550	0.538	0.529	0.527	0.528	0.534	0.539	₹		1 1	7								
Final measured crack	lengthe (in)								J, lbf-in/in^2	0	1 1		1							
0.775	0.787	0.791	0.790	0.788	0.780	0.772	0.744	0.696	=		I = I		/							
								х	800 ر	0	$I \mid II$		/							
Acces in this language is a second	u. (!)	0.5408			()			0.541			1 11									
Ave. initial crack length Ave. final crack length		0.5408			aoq (in) Compliance	Adi Eactor		0.890	600	0	I I	/						•		
Delta a measured (in)	. ()	0.2329			Effective Mo			24.0			- 11	/								
Delta a predicted (in)		0.0773			2	uu.uo (o.)		20		- 1	- 11	سيسسيد	•			/				
, ,									400	0 /		1				- 1				
Results											711	- 1				- /				
JQ (E1820)			bf-in/in^2						200	o //		- /				-				
KJIC(E'*JQ)^1/2		106.3 k	si sqrt(in)								11	/								
Qualification of Data					Qualification	of JQ as J	IC			0	11	1								
7.4.2: precrack length		valid								0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
9.1.4.1; precrack		valid			A9.10.1; thic		valid			0.00	0.01	0.02	0.03				0.07	0.00	0.09	0.10
9.1.4.2; final crack		invalid			A9.10.2; liga		valid							crac	k extensi	on, in				
9.1.5.1; Da meas		valid			A9.11; slope		valid			A.II			·	S1.						
9.1.5.2; Da pred A9.6.4; # of pnts in reg	1 Δ	invalid valid								All resi	uus are rep	orted For In	ioimation (Jilly						
A9.6.4; # of pnts in reg		valid								Applica	able Specif	ication: AS	TM E1820-	20						
	,													-						

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EPRI Task ID: 1-110095-01-02;

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys;

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A9.9.1; C2<1

A9.9.2.1; a0q-a0

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

valid

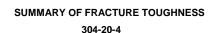
valid

valid

valid

invalid





Specimen Type: CT Material: SS304 Drawing No.: Fig. 2

Qualification of JQ as JIC

valid

valid

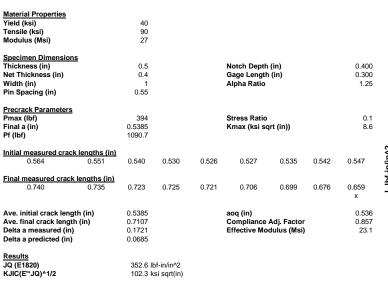
valid

A9.10.1; thickness

A9.10.2: ligament

A9.11; slope

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer



valid

valid

valid

valid

valid

valid

valid

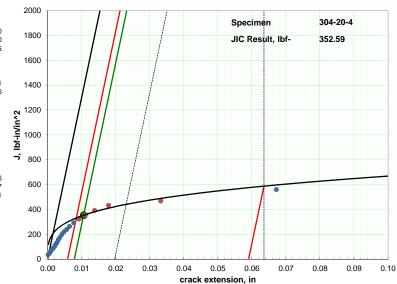
valid

valid

invalid

invalid

invalid



ASTM E1820-20 Standard Test

All results are reported For Information Only

Applicable Specification: ASTM E1820-20

Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys; EPRI Task ID: 1-110095-01-02;

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element

Temperature

Relative Humidity:

Qualification of Data

7.4.2: precrack length

A9.6.4; # of pnts in reg.A

A9.6.4; # of pnts in reg.B

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

9.1.4.1; precrack

9.1.5.1; Da meas

9.1.5.2; Da pred

A9.9.2.1; a0q-a0

A9.9.1: C2<1

9.1.4.2; final crack

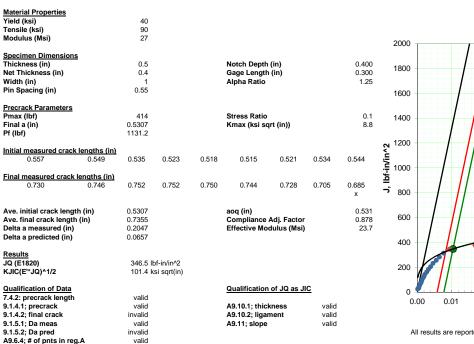
RŤ 37%

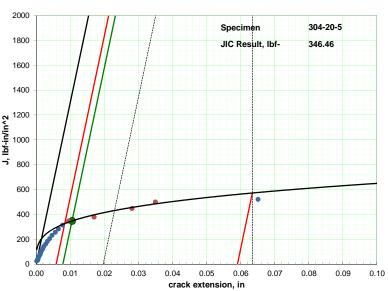


SUMMARY OF FRACTURE TOUGHNESS 304-20-5

Specimen Type: CT Material: SS304 Drawing No.: Fig. 2

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer





ASTM E1820-20 Standard Test

All results are reported For Information Only

Applicable Specification: ASTM E1820-20

Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys; EPRI Task ID: 1-110095-01-02;

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A9.6.4; # of pnts in reg.B

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

A9.9.1: C2<1

A9.9.2.1; a0q-a0

valid

valid

valid

valid

valid

invalid

element

Temperature

Relative Humidity:

RŤ 37%



Requestor: Wall

0.09

0.10

Company: Electric Power

P.O. No.: 4700007062 Job No.: 02039-011217

Research Institute

SUMMARY OF FRACTURE TOUGHNESS 304-40-1

Specimen Type: CT SS304 Material: Drawing No.: Fig. 2 Temperature RŤ Machining Source: Customer Relative Humidity: 36%

Material Properties ASTM E1820-20 Standard Test 40 Yield (ksi) Tensile (ksi) 90 Modulus (Msi) 27 2000 304-40-1 Specimen Dimensions Specimen Thickness (in) 0.5 Notch Depth (in) 0.400 1800 JIC Result, lbf-365.75 Net Thickness (in) 0.4 Gage Length (in) 0.300 Width (in) Alpha Ratio 1.25 Pin Spacing (in) 0.55 1600 Precrack Parameters 413 Stress Ratio 0.1 Pmax (lbf) 1400 Final a (in) 0.5287 Kmax (ksi sqrt (in)) 8.7 Pf (lbf) 1142.2 1200 2 Initial measured crack lengths (in) 0.520 0.521 0.526 0.531 0.538 0.542 0.544 lbf-in/in 0.520 0.521 1000 Final measured crack lengths (in) 0.742 0.739 0.737 0.725 0.718 0.713 0.705 800 Ave. initial crack length (in) 0.5287 0.526 aoq (in) 600 0.7313 Compliance Adj. Factor 0.835 Ave. final crack length (in) Delta a measured (in) 0.2027 Effective Modulus (Msi) 22.6 Delta a predicted (in) 0.0619 400 Results JQ (E1820) 365.8 lbf-in/in^2 200 KJIC(E'*JQ)^1/2 104.2 ksi sqrt(in) **Qualification of Data** Qualification of JQ as JIC 7.4.2: precrack length valid 0.06 0.01 0.02 0.03 0.04 0.05 0.07 0.08 0.00 9.1.4.1; precrack A9.10.1; thickness valid valid crack extension, in 9.1.4.2; final crack valid A9.10.2: ligament valid 9.1.5.1; Da meas valid A9.11; slope valid 9.1.5.2; Da pred invalid All results are reported For Information Only A9.6.4; # of pnts in reg.A valid

Applicable Specification: ASTM E1820-20

Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys; EPRI Task ID: 1-110095-01-02;

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A9.6.4; # of pnts in reg.B

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

A9.9.1: C2<1

A9.9.2.1; a0q-a0

valid

valid

valid

valid

valid

invalid

element



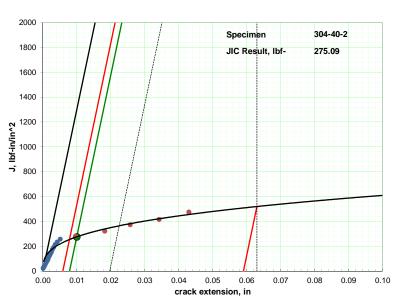
SUMMARY OF FRACTURE TOUGHNESS 304-40-2

Specimen Type: CT SS304 Material: Drawing No.: Fig. 2 RŤ Temperature: Relative Humidity:

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer

Material Properties		40							
Yield (ksi) Tensile (ksi)		90							
Modulus (Msi)		27							
wodulus (wsi)		21							2
Specimen Dimensions									
Thickness (in)		0.5			Notch Depth	(in)		0.400	
Net Thickness (in)		0.4			Gage Length	(in)		0.300	1
Width (in)		1			Alpha Ratio			1.25	
Pin Spacing (in)		0.55							1
Precrack Parameters Pmax (lbf)		394			Stress Ratio			0.1	
Final a (in)		0.5401			Kmax (ksi so	ert (in))		8.7	1
Pf (lbf)		1082.7			Miliax (KSI SC	[(III))		0.7	
1 1 (IDI)		1002.7							a. 1
Initial measured crack	lenaths (in)								δ,
0.543	0.547	0.546	0.544	0.542	0.538	0.533	0.533	0.532	.⊑
									J, Ibf-in/in^2
Final measured crack	engths (in)								Ė
0.686	0.705	0.722	0.730	0.737	0.739	0.736	0.737	0.739	Ξ,
									•
Ave. initial crack lengt	h (in)	0.5401			aog (in)			0.541	
Ave. final crack length		0.7273			Compliance	Adi. Factor		1.059	
Delta a measured (in)	()	0.1872			Effective Mo			28.6	
Delta a predicted (in)		0.0438							
. , ,									
Results									
JQ (E1820)			of-in/in^2						
KJIC(E'*JQ)^1/2		90.3 k	si sqrt(in)						
Qualification of Data					Qualification	of JQ as J	IC.		
7.4.2: precrack length		valid			<u> </u>	0.04400	<u></u>		
9.1.4.1; precrack		valid			A9.10.1; thic	kness	valid		
9.1.4.2; final crack		valid			A9.10.2; ligar		valid		
					A9.11; slope		valid		
9.1.5.1; Da meas		valid							
		valid invalid							
9.1.5.1; Da meas	.А								
9.1.5.1; Da meas 9.1.5.2; Da pred		invalid			, .				
9.1.5.1; Da meas 9.1.5.2; Da pred A9.6.4; # of pnts in reg A9.6.4; # of pnts in reg A9.9.1; C2<1		invalid valid valid valid							
9.1.5.1; Da meas 9.1.5.2; Da pred A9.6.4; # of pnts in reg A9.6.4; # of pnts in reg A9.9.1; C2<1 A9.9.2.1; a0q-a0	.В	invalid valid valid valid valid							
9.1.5.1; Da meas 9.1.5.2; Da pred A9.6.4; # of pnts in reg A9.6.4; # of pnts in reg A9.9.1; C2<1	.B JQ	invalid valid valid valid							

valid



ASTM E1820-20 Standard Test

All results are reported For Information Only

Applicable Specification: ASTM E1820-20

Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys; EPRI Task ID: 1-110095-01-02;

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A9.9.2.2; correlation

element

36%



SUMMARY OF FRACTURE TOUGHNESS 304-40-3

Specimen Type: CT SS304 Material: Drawing No.: Fig. 2 Temperature: Relative Humidity: RŤ 36%

element

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer

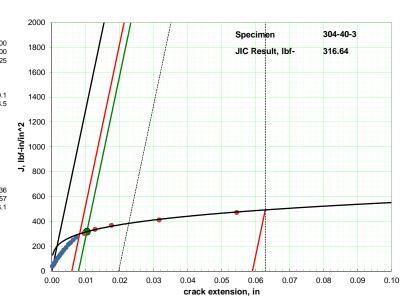
Material Properties Yield (ksi) Tensile (ksi) Modulus (Msi)		40 90 27							;
Specimen Dimensions Thickness (in) Net Thickness (in) Width (in) Pin Spacing (in)		0.5 0.4 1 0.55			Notch Depth (Gage Length Alpha Ratio			0.400 0.300 1.25	
Precrack Parameters Pmax (lbf) Final a (in) Pf (lbf)		394 0.5353 1107.4			Stress Ratio Kmax (ksi sqr	t (in))		0.1 8.5	
Initial measured crack len 0.529	ogths (in) 0.528	0.526	0.526	0.528	0.537	0.544	0.551	0.555	J, Ibf-in/in^2
Final measured crack leng 0.724 x	gths (in) 0.743	0.769	0.796	0.803	0.803	0.798	0.786	0.753	J, Ibf
Ave. initial crack length (in Ave. final crack length (in Delta a measured (in) Delta a predicted (in)		0.5353 0.7797 0.2444 0.0554			aoq (in) Compliance A Effective Mod			0.536 0.857 23.1	
Results JQ (E1820) KJIC(E'*JQ)^1/2		316.6 lb 96.9 ks	f-in/in^2 si sqrt(in)						
Qualification of Data 7.4.2: precrack length 9.1.4.1; precrack 9.1.4.2; final crack 9.1.5.1; Da meas 9.1.5.2; Da pred A9.6.4; # of pnts in reg.A		valid valid invalid valid invalid valid			Qualification (A9.10.1; thick A9.10.2; ligam A9.11; slope	ness	valid valid valid		
A9.6.4; # of pnts in reg.B A9.9.1; C2<1		valid valid							

valid

valid

valid

invalid



ASTM E1820-20 Standard Test

All results are reported For Information Only

Applicable Specification: ASTM E1820-20

Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys; EPRI Task ID: 1-110095-01-02;

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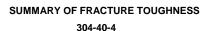
A9.9.2.1; a0q-a0

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation





Specimen Type: CT SS304 Material: Drawing No.: Fig. 2 Temperature: Relative Humidity: RŤ 36%

7.4.2: precrack length

A9.6.4; # of pnts in reg.A

A9.6.4; # of pnts in reg.B

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

9.1.4.1; precrack

9.1.5.1; Da meas

9.1.5.2; Da pred

A9.9.1: C2<1

A9.9.2.1; a0q-a0

9.1.4.2; final crack

element

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer

Material Properties Yield (ksi) Tensile (ksi) Modulus (Msi)	40 90 27							
Specimen Dimensions Thickness (in) Net Thickness (in) Width (in) Pin Spacing (in)	0.5 0.4 1 0.55			Notch Depth Gage Length Alpha Ratio			0.400 0.300 1.25	
Precrack Parameters Pmax (lbf) Final a (in) Pf (lbf)	394 0.5369 1099.2			Stress Ratio Kmax (ksi so	ırt (in))		0.1 8.6	
Initial measured crack lengths (in) 0.572 0.534	0.532	0.528	0.526	0.528	0.536	0.547	0.557	n/in^2
Final measured crack lengths (in) 0.778 0.797	0.807	0.815	0.820	0.819	0.816	0.791	0.742 x	J, Ibf-in/in^2
Ave. initial crack length (in) Ave. final crack length (in) Delta a measured (in) Delta a predicted (in)	0.5368 0.8032 0.2664 0.0857			aoq (in) Compliance Effective Mo			0.536 0.882 23.8	
Results JQ (E1820) KJIC(E**JQ)^1/2	404.7 lb 109.6 ks	f-in/in^2 si sqrt(in)						
Qualification of Data				Qualification	of JQ as JI	c		

A9.10.1; thickness

A9.10.2: ligament

A9.11; slope

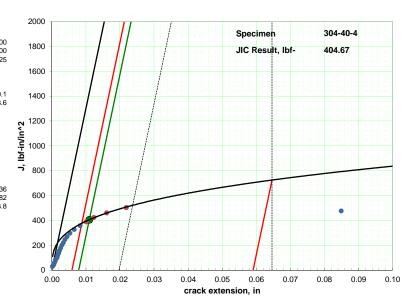
valid

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ASTM E1820-20 Standard Test

All results are reported For Information Only

Applicable Specification: ASTM E1820-20

Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys; EPRI Task ID: 1-110095-01-02;

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304-40-5 354.02

0.09

0.08

0.10



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SUMMARY OF FRACTURE TOUGHNESS 304-40-5

Specimen Type: CT SS304 Material: Drawing No.: Fig. 2 RŤ Temperature: Relative Humidity: 36%

element

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer

Material Properties Yield (ksi) Tensile (ksi) Modulus (Msi)	40 90 27		ASTM E1820-20 Standard Test	
Specimen Dimensions Thickness (in) Net Thickness (in) Width (in) Pin Spacing (in)	0.5 0.4 1 0.55	Notch Depth (in) Gage Length (in) Alpha Ratio	0.400 0.300 1.25 1600 Specimen JIC Result, Ib	of-
Precrack Parameters Pmax (lbf) Final a (in) Pf (lbf)	394 0.5372 1097.7	Stress Ratio Kmax (ksi sqrt (in))	0.1 1400 8.6 1200	
<u>Initial measured crack lengths (in)</u> 0.575 0.564 <u>Final measured crack lengths (in)</u> 0.780 0.818	0.550 0.537 0.529 0.841 0.842 0.843		0.520 1000 0.766 3 800 1000	
x Ave. initial crack length (in) Ave. final crack length (in) Delta a measured (in) Delta a predicted (in)	0.5372 0.8292 0.292 0.1516	aoq (in) Compliance Adj. Factor Effective Modulus (Msi)	x 800 0.536 0.928 25.1 400	
Results JQ (E1820) KJIC(E**JQ)^1/2 Qualification of Data	354.0 lbf-in/in/2 102.5 ksi sqrt(in)	Qualification of JQ as JIC	200	
7.4.2: precrack length 9.1.4.1; precrack 9.1.4.2; final crack 9.1.5.1; Da meas 9.1.5.2; Da pred A9.6.4; # of pnts in reg.A A9.6.4; # of pnts in reg.B	valid valid invalid valid invalid valid valid	A9.10.1; thickness valid A9.10.2; ligament valid A9.11; slope valid	0.00 0.01 0.02 0.03 0.04 0.05 0.06 0. crack extension, in All results are reported For Information Only Applicable Specification: ASTM E1820-20	.07

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Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

EPRI Task ID: 1-110095-01-02;

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys;

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A9.9.1; C2<1

A9.9.2.1; a0q-a0

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

valid

valid

valid

valid

invalid

SUMMARY OF FRACTURE TOUGHNESS 304-60-1

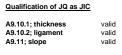
Specimen Type: CT
Material: SS304
Drawing No.: Fig. 2
Temperature: RT
Relative Humidity: 37%

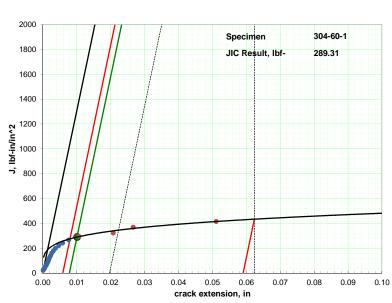
element

Requestor: Wall
Company: Electric Power
Research Institute
P.O. No.: 4700007062
Job No.: 02039-011217
Machining Source: Customer

Material Properties									
Yield (ksi)		40							
Tensile (ksi)		90							
Modulus (Msi)		27							
Specimen Dimensions									
Thickness (in)		0.5			Notch Depth	(in)		0.400	
Net Thickness (in)		0.4			Gage Length			0.300	
Width (in)		1			Alpha Ratio	. ,		1.25	
Pin Spacing (in)		0.55							
Precrack Parameters									
Pmax (lbf)		394			Stress Ratio			0.1	
Final a (in)		0.5342			Kmax (ksi sq	rt (in))		8.5	
Pf (lbf)		1113.1							
Initial management arealy	ametha (in)								Ŋ
Initial measured crack I 0.548	0.539	0.537	0.538	0.537	0.533	0.528	0.524	0.525	`≥
0.546	0.539	0.537	0.536	0.537	0.533	0.526	0.524	0.525	≅
Final measured crack le	enaths (in)								J, Ibf-in/in^2
0.754	0.808	0.818	0.824	0.817	0.805	0.788	0.765	0.731	≅
0.701	0.000	0.010	0.02	0.011	0.000	0.700	0.7 00	х	٦,
Ave. initial crack length	ı (in)	0.5342			aoq (in)			0.531	
Ave. final crack length	(in)	0.7959			Compliance A	Adj. Factor		0.859	
Delta a measured (in)		0.2617			Effective Mod	dulus (Msi)		23.2	
Delta a predicted (in)		0.1721							
Results									
JQ (E1820)		289.3 lb	f_in/in/2						
KJIC(E'*JQ)^1/2			si sqrt(in)						
NOIC(E 3Q)*1/2		92.0 K	or oqrit(iii)						







ASTM E1820-20 Standard Test

All results are reported For Information Only

Applicable Specification: ASTM E1820-20

Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys; EPRI Task ID: 1-110095-01-02;

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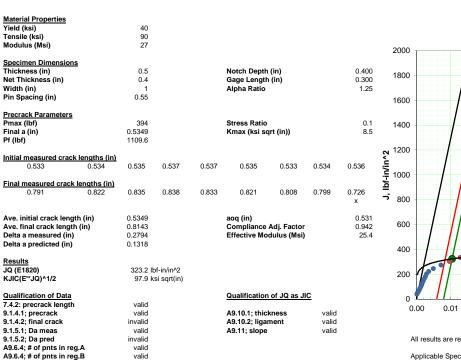
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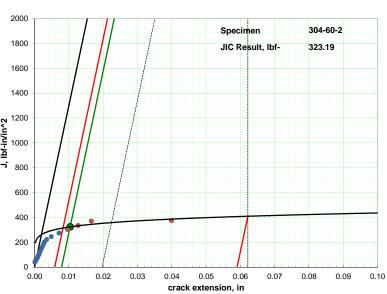


Machining Source: Customer

SUMMARY OF FRACTURE TOUGHNESS 304-60-2

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217





ASTM E1820-20 Standard Test

All results are reported For Information Only

Applicable Specification: ASTM E1820-20

Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys; EPRI Task ID: 1-110095-01-02;

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A9.9.1: C2<1

A9.9.2.1; a0q-a0

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

valid

valid

valid

invalid

invalid

element

Specimen Type:

Relative Humidity:

Material:

Drawing No.:

Temperature

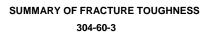
CT

RŤ 37%

SS304

Fig. 2





Specimen Type: CT SS304 Material: Drawing No.: Fig. 2 Temperature: Relative Humidity: RŤ 37%

element

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer

Material Properties Yield (ksi) Tensile (ksi) Modulus (Msi)	40 90 27							
Specimen Dimensions Thickness (in) Net Thickness (in) Width (in) Pin Spacing (in)	0.5 0.4 1 0.55			Notch Depth Gage Length Alpha Ratio			0.400 0.300 1.25	
Precrack Parameters Pmax (lbf) Final a (in) Pf (lbf)	394 0.5415 1075.3			Stress Ratio Kmax (ksi so	ırt (in))		0.1 8.7	
Initial measured crack lengths (in) 0.533 0.536	0.539	0.544	0.546	0.545	0.544	0.542	0.540	lhf-in/in^2
Final measured crack lengths (in) 0.604 0.654 x	0.704	0.723	0.725	0.727	0.709	0.669	0.603 x	P
Ave. initial crack length (in) Ave. final crack length (in) Delta a measured (in) Delta a predicted (in)	0.5415 0.6894 0.1479 0.0686			aoq (in) Compliance Effective Mo			0.541 1.007 27.2	
Results JQ (E1820) KJIC(E**JQ)^1/2		of-in/in^2 si sqrt(in)						
Qualification of Data				Qualification	of JQ as J	<u>IC</u>		

A9.10.1; thickness

A9.10.2: ligament

A9.11; slope

valid

valid

valid

valid

valid

invalid

invalid

invalid

valid

valid

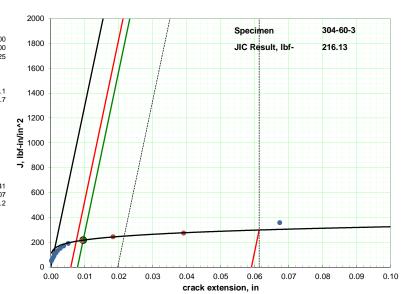
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ASTM E1820-20 Standard Test

All results are reported For Information Only

Applicable Specification: ASTM E1820-20

Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys; EPRI Task ID: 1-110095-01-02;

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7.4.2: precrack length

A9.6.4; # of pnts in reg.A

A9.6.4; # of pnts in reg.B

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

9.1.4.1; precrack

9.1.5.1; Da meas

9.1.5.2; Da pred

A9.9.1: C2<1

A9.9.2.1; a0q-a0

9.1.4.2; final crack



SUMMARY OF FRACTURE TOUGHNESS 304-60-4

Specimen Type: CT SS304 Material: Drawing No.: Fig. 2 Temperature: Relative Humidity: RŤ 37%

element

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer

Material Properties									
Yield (ksi)		40							
Tensile (ksi)		90							
Modulus (Msi)		27							
Specimen Dimensions									
Thickness (in)		0.5			Notch Depth			0.400	
Net Thickness (in)		0.4			Gage Length	(in)		0.300	
Width (in)		_ 1			Alpha Ratio			1.25	
Pin Spacing (in)		0.55							
Dragged Davameters									
Precrack Parameters Pmax (lbf)		394			Stress Ratio			0.1	
Final a (in)		0.5385			Kmax (ksi sq	rt (in))		8.6	
Pf (lbf)		1090.6			Miliax (KSI SQ	()		0.0	
1 1 (IDI)		1030.0							
Initial measured crack le	naths (in)								7
0.537	0.535	0.534	0.536	0.538	0.542	0.542	0.541	0.543	₽.
									J, Ibf-in/in^2
Final measured crack lea									ģ
0.781	0.813	0.832	0.835	0.841	0.847	0.845	0.825	0.801	Ξ
									•
Acces in hill a consent formath	(!\	0.5385			(!)			0.500	
Ave. initial crack length Ave. final crack length (i		0.5385			aoq (in) Compliance	Ad: Fastar		0.536 0.881	
Delta a measured (in)	n)	0.6266			Effective Mo			23.8	
Delta a predicted (in)		0.0537			Ellective MO	uuius (WiSi)		23.0	
Delta a predicted (III)		0.0557							
Results									
JQ (E1820)		341.3 lb	f-in/in^2						
KJIC(E'*JQ)^1/2		100.6 ks	i sart(in)						
, .			-1 ()						
Qualification of Data					Qualification	of JQ as JI	<u>C</u>		
7.4.2: precrack length		valid					_		
9.1.4.1; precrack		valid			A9.10.1; thicl		valid		
9.1.4.2; final crack		valid			A9.10.2; ligar	nent	valid		
9.1.5.1; Da meas		valid			A9.11; slope		valid		

invalid

valid

valid

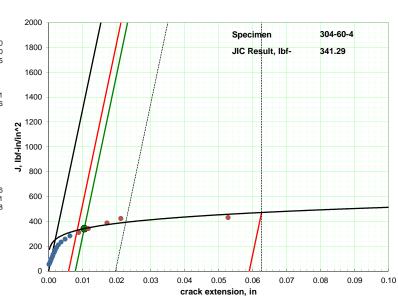
valid

valid

valid

invalid

invalid



ASTM E1820-20 Standard Test

All results are reported For Information Only

Applicable Specification: ASTM E1820-20

Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys; EPRI Task ID: 1-110095-01-02;

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9.1.5.2; Da pred

A9.9.1; C2<1

A9.9.2.1; a0q-a0

A9.6.4; # of pnts in reg.A

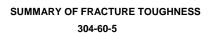
A9.6.4; # of pnts in reg.B

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation





Specimen Type: CT SS304 Material: Drawing No.: Fig. 2

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer

Material Properties Yield (ksi) Tensile (ksi) Modulus (Msi)		40 90 27							
Specimen Dimensions Thickness (in) Net Thickness (in) Width (in) Pin Spacing (in)		0.5 0.4 1 0.55			Notch Depth Gage Length Alpha Ratio			0.400 0.300 1.25	
Precrack Parameters Pmax (lbf) Final a (in) Pf (lbf)		394 0.5401 1082.6			Stress Ratio Kmax (ksi sq	rt (in))		0.1 8.7	
Initial measured crack 0.528	lengths (in) 0.535	0.550	0.558	0.558	0.552	0.537	0.514	0.507	lbf-in/in^2
Final measured crack le 0.643	engths (in) 0.665	0.683	0.693	0.694	0.683	0.660	0.621	0.594 x	J. Ibf-i
Ave. initial crack length Ave. final crack length Delta a measured (in) Delta a predicted (in)		0.5401 0.6647 0.1246 0.0442			aoq (in) Compliance A Effective Mod			0.541 0.859 23.2	
Results JQ (E1820) KJIC(E**JQ)^1/2			of-in/in^2 si sqrt(in)						

valid

valid

valid

valid

valid

valid

valid

valid

valid

invalid

invalid

invalid

Qualification of JQ as JIC

valid

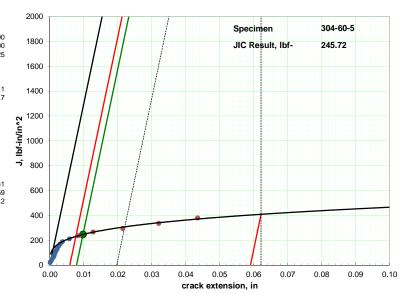
valid

valid

A9.10.1; thickness

A9.10.2: ligament

A9.11; slope



ASTM E1820-20 Standard Test

All results are reported For Information Only

Applicable Specification: ASTM E1820-20

Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys; EPRI Task ID: 1-110095-01-02;

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element

Temperature: Relative Humidity:

Qualification of Data

7.4.2: precrack length

A9.6.4; # of pnts in reg.A

A9.6.4; # of pnts in reg.B

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

9.1.4.1; precrack

9.1.5.1; Da meas

9.1.5.2; Da pred

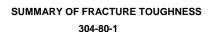
A9.9.1: C2<1

A9.9.2.1; a0q-a0

9.1.4.2; final crack

RŤ 37%

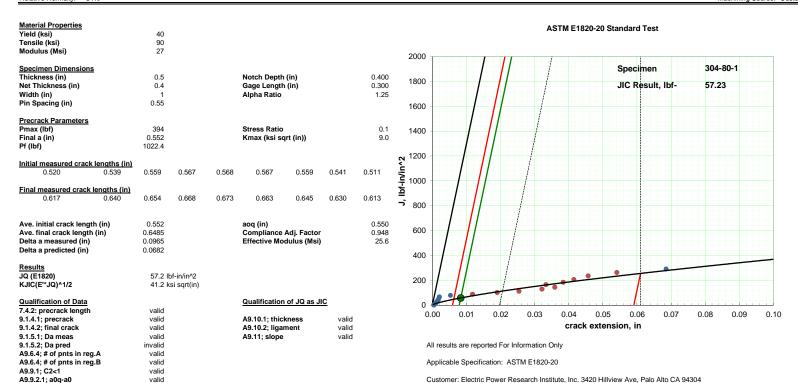




Specimen Type: CT Material: SS304 Drawing No.: Fig. 2 Temperature RŤ Relative Humidity: 54%

element

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer



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Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys;

EPRI Task ID: 1-110095-01-02;

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A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

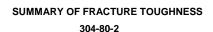
valid

valid

valid



Machining Source: Customer



Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217

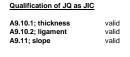
Specimen Type: CT Material: SS304 Drawing No.: Fig. 2 Temperature RŤ Relative Humidity: 54%

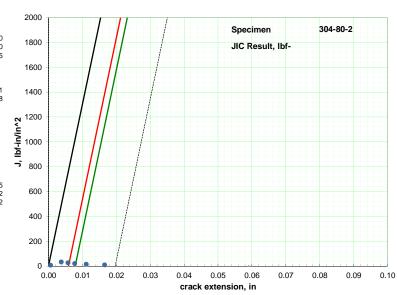
element

Material Properties 40 Yield (ksi) Tensile (ksi) 90 Modulus (Msi) 27 Specimen Dimensions Thickness (in) 0.5 Notch Depth (in) 0.400 Net Thickness (in) 0.4 Gage Length (in) 0.300 Width (in) Alpha Ratio 1.25 Pin Spacing (in) 0.55 Precrack Parameters 394 Stress Ratio 0.1 Pmax (lbf) Final a (in) 0.5434 Kmax (ksi sqrt (in)) 8.8 Pf (lbf) 1065.7 Initial measured crack lengths (in) 0.577 0.568 0.551 0.530 0.513 0.501 0.490 0.573 0.577 х Final measured crack lengths (in) 0.608 0.617 0.626 0.612 0.593 0.562 0.520 Ave. initial crack length (in) 0.5434 0.555 aoq (in) 0.5963 Compliance Adj. Factor Ave. final crack length (in) 0.932 Delta a measured (in) 0.0529 Effective Modulus (Msi) 25.2 Delta a predicted (in) 0.0319 Results JQ (E1820) 0.0 lbf-in/in^2 KJIC(E'*JQ)^1/2 0.0 ksi sqrt(in)

Qualification of Data 7.4.2: precrack length valid 9.1.4.1; precrack invalid 9.1.4.2; final crack invalid 9.1.5.1; Da meas valid 9.1.5.2; Da pred invalid A9.6.4; # of pnts in reg.A invalid A9.6.4; # of pnts in reg.B invalid A9.9.1: C2<1 invalid A9.9.2.1; a0q-a0 invalid A9.9.2.2; # of pnts for JQ invalid A9.9.2.2; # of pnts < JQ invalid

invalid





ASTM E1820-20 Standard Test

All results are reported For Information Only

Applicable Specification: ASTM E1820-20

Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys; EPRI Task ID: 1-110095-01-02;

No valid J1C could be determined.

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A9.9.2.2; correlation





Specimen Type: CT SS304 Material: Drawing No.: Fig. 2 RT Temperature: Relative Humidity: 54%

element

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer

Material Properties Yield (ksi) Tensile (ksi) Modulus (Msi)	40 90 27		ASTM E1820-20 Standard Test
Specimen Dimensions Thickness (in) Net Thickness (in) Width (in) Pin Spacing (in)	0.5 0.4 1 0.55	Notch Depth (in) 0.400 Gage Length (in) 0.300 Alpha Ratio 1.25	2000 1800 Specimen 304-80-3 JIC Result, lbf- 233.07
Precrack Parameters Pmax (lbf) Final a (in) Pf (lbf)	394 0.5434 1065.6	Stress Ratio 0.1 Kmax (ksi sqrt (in)) 8.8	1400
Initial measured crack lengths (in 0.534 0.547 Final measured crack lengths (in)	0.560 0.563 0.56	52 0.555 0.539 0.512 0.485 x	2 1200 Lip 1000
0.663 0.694	0.715 0.732 0.75 x	67 0.731 0.705 0.673 0.629 x	<u>a</u> 800
Ave. initial crack length (in) Ave. final crack length (in) Delta a measured (in) Delta a predicted (in)	0.5434 0.7066 0.1632 0.0897	aoq (in) 0.541 Compliance Adj. Factor 0.907 Effective Modulus (Msi) 24.5	400
Results JQ (E1820) KJIC(E**JQ)^1/2	233.1 lbf-in/in/2 83.2 ksi sqrt(in)		200
Qualification of Data 7.4.2: precrack length 9.1.4.1; precrack 9.1.4.2; final crack 9.1.5.1; Da meas 9.1.5.2; Da pred A9.6.4; # of pnts in reg.A A9.6.4; # of pnts in reg.B	valid invalid invalid valid invalid valid valid	Qualification of JQ as JIC A9.10.1; thickness valid A9.10.2; ligament valid A9.11; slope valid	0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 crack extension, in All results are reported For Information Only Applicable Specification: ASTM E1820-20
A9.9.1; C2<1	valid		

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Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

EPRI Task ID: 1-110095-01-02;

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys;

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A9.9.2.1; a0q-a0

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

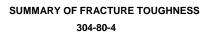
A9.9.2.2; correlation

valid

valid

invalid

invalid



Specimen Type: CT
Material: SS304
Drawing No.: Fig. 2
Temperature: RT
Relative Humidity: 54%

7.4.2: precrack length

A9.6.4; # of pnts in reg.A

A9.6.4; # of pnts in reg.B

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

9.1.4.1; precrack

9.1.5.1; Da meas

9.1.5.2; Da pred

A9.9.1: C2<1

A9.9.2.1; a0q-a0

9.1.4.2; final crack

element

Requestor: Wall
Company: Electric Power
Research Institute
P.O. No.: 4700007062
Job No.: 02039-011217
Machining Source: Customer

Material Properties Yield (ksi) Tensile (ksi) Modulus (Msi)		40 90 27								2000
Specimen Dimensions Thickness (in) Net Thickness (in) Width (in) Pin Spacing (in)	hickness (in) 0.5 et Thickness (in) 0.4 lidth (in) 1			Notch Depth (in) Gage Length (in) Alpha Ratio				0.400 0.300 1.25	1 25	
Precrack Parameters Pmax (lbf) Final a (in) Pf (lbf)	394 0.5514 1025.2			Stress Ratio Kmax (ksi sqrt (in))			0.1 9.0		1400	
Initial measured crack I	engths (in)								7	1200
0.569	0.574	0.576	0.573	0.568	0.557	0.536	0.500 x	0.484 x	J, Ibf-in/in^2	1000
0.660	0.682	0.684	0.684	0.671	0.657	0.631	0.590 x	0.554 x	J. ID	800
Ave. initial crack length (in) Ave. final crack length (in) Delta a measured (in) Delta a predicted (in)		0.5514 0.6509 0.0995 0.0423			aoq (in) Compliance Adj. Factor Effective Modulus (Msi)			0.551 0.885 23.9		600 400
Results										400
JQ (E1820) KJIC(E**JQ)^1/2		268.1 lbf-in/in/2 89.2 ksi sqrt(in)								200
Qualification of Data					Qualification	of JQ as JI	<u>c</u>			٥

A9.10.1; thickness

A9.10.2; ligament

A9.11; slope

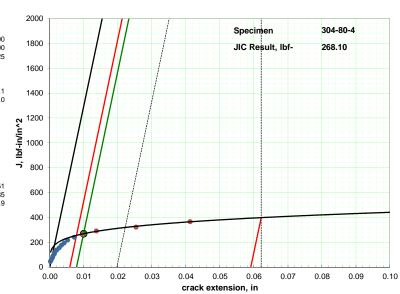
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invalid

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invalid



ASTM E1820-20 Standard Test

All results are reported For Information Only

Applicable Specification: ASTM E1820-20

Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys; EPRI Task ID: 1-110095-01-02;

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304-80-5

240.48



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SUMMARY OF FRACTURE TOUGHNESS 304-80-5

Specimen Type: CT Material: SS304 Drawing No.: Fig. 2 RŤ

valid

valid

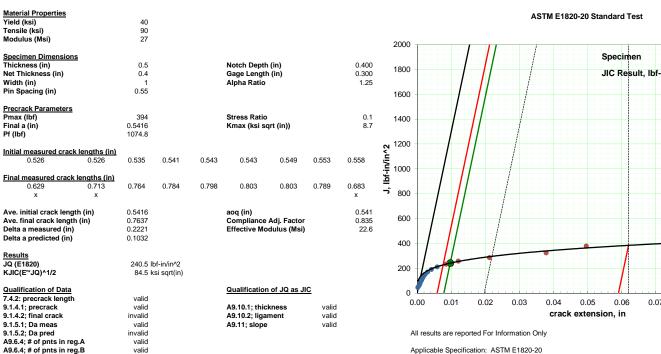
valid

valid

invalid

Requestor: Wall Company: Electric Power Research Institute P.O. No.: 4700007062 Job No.: 02039-011217 Machining Source: Customer

0.10



Applicable Specification: ASTM E1820-20

Customer: Electric Power Research Institute, Inc. 3420 Hillview Ave, Palo Alto CA 94304

Additional customer nos.: SOW: Compact Tension Testing of Cold-Worked Stainless Steel Alloys; EPRI Task ID: 1-110095-01-02;

0.06

0.07

0.08

0.09

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A9.9.1: C2<1

A9.9.2.1; a0q-a0

A9.9.2.2; # of pnts for JQ

A9.9.2.2; # of pnts < JQ

A9.9.2.2; correlation

element

Temperature

Relative Humidity:

54%