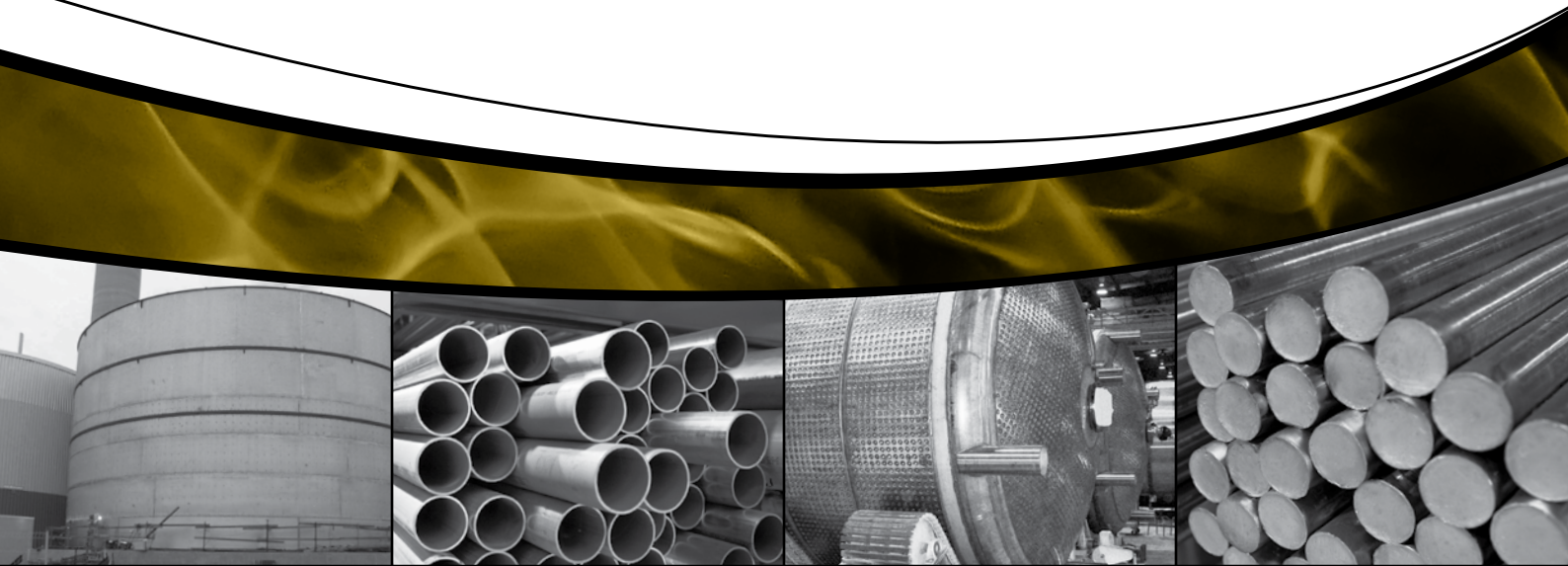




## LDX 2101<sup>®</sup> Fabrication

LDX 2101<sup>®</sup> is a lean duplex stainless steel designed for general purpose use. Like other duplex stainless steels, LDX 2101 provides both superior strength and chloride stress corrosion cracking resistance compared to 300 series stainless steels.



The Global Leader in Specialty Metals

Table of Contents

Performance Profile	2
Specification	2
Chemical Composition	2
Features	2
Applications	2
Physical Properties	2
Mechanical Properties	3
Hot Forming	3
Cold Forming	3
Heat Treatment	3
Tube Bending and Rolling	3
Machining	4
<b>Welding</b>	<b>4-10</b>
Heat Input	4
Preheating	4
Interpass Temperatures	5
Microstructure	5
Filler Metals	5
Welding Process vs Properties	5
SMAW (Shielded Metal Arc Welding)	6
GMAW (Gas Metal Arc Welding)	6
SAW (Submerged Arc Welding)	7
FCAW (Flux Core Arc Welding)	7
GTAW (Gas Tungsten Arc Welding)	7-8
Dissimilar Metal Welding	8
Welding Joint Design	8-9
<i>Square Butt Joint</i>	8
<i>Single "V" Joint</i>	8
<i>Double "V" Joint</i>	9
<i>Single "U" Joint</i>	9
<i>Double "U" Joint</i>	9
<i>"J" Groove Joint</i>	9
<i>"T" Joint</i>	9
<i>Openings</i>	9
Repair Welding	10
Quality Assurance	10
Ferrite Measurement	10

LDX 2101® is a lean duplex stainless steel designed for general purpose use. Like other duplex stainless steels, LDX 2101 provides both superior strength and chloride stress corrosion cracking resistance compared to 300 series stainless steels. The use of manganese ensures proper ferrite-austenite phase balance, while allowing a reduction in nickel content. As a result, LDX 2101 is priced competitively with 304/304L and 316/316L stainless steels.

The combination of a duplex structure and high nitrogen content provide significantly higher strength levels than 300 series stainless steels. Often a lighter gauge of LDX 2101 can be utilized, while maintaining the same strength as a 300 series fabrication. The resultant weight savings can dramatically reduce the material and fabrication costs of a component. Designing to take advantage of the higher strength of LDX 2101 can result in significant cost savings.

**Specifications**

UNS: S32101 W. Nr./EN: 1.4162 ASTM: A 240 ASME: SA-240

**Chemical Composition, %**

	Ni	Cr	Mo	Mn	Cu	Si	C	N	S	P	Fe
MIN	1.35	21.0	0.1	4.0	0.1	—	—	0.2	—	—	—
MAX	1.7	22.0	0.8	6.0	0.8	1.0	0.04	0.25	0.03	0.04	balance

**Features**

- High resistance to chloride stress corrosion cracking (SCC)
- High strength
- Good fatigue strength
- Chloride pitting resistance comparable to type 316L stainless
- Good general corrosion resistance
- Good machinability and weldability
- Useful up to 600°F

**Applications**

- Chemical process pressure vessels, piping and heat exchangers
- Pulp and paper mill equipment
- Mixers and agitators
- Storage tanks
- Waste water handling systems
- Ethanol production

**Physical Properties**

Density: 0.278 lb/in<sup>3</sup> Melting Range: 2525-2630°F Poisson's Ratio: 0.3 Electrical Resistivity: 481 Ohm-circ mil/ft

Temperature, °F	70	212	392	572
Coefficient* of Thermal Expansion, in/in°F x 10 <sup>-6</sup>	—	7.5	7.8	8.1
Thermal Conductivity Btu • ft/ft <sup>2</sup> • hr • °F	9.2	9.8	11.0	11.6
Modulus of Elasticity Dynamic, psi x 10 <sup>6</sup>	29.7	29	27.6	26.1

\* 70°F to indicated temperature.

Mechanical Properties

Ultimate Tensile Strength, ksi	94
0.2% Yield Strength, ksi	65
Elongation, %	30
Hardness MAX, Brinell	290

Minimum Elevated Temperature Tensile Properties, Plate

Temperature, °F	212	302	392	572
Ultimate Tensile Strength, ksi	85.6	81.2	78.3	78.3
0.2% Yield Strength, ksi	55.1	50.8	47.9	43.5

ASME Boiler & Pressure Vessel Code, Section VIII, Division 1, Allowable Stress Values, ksi

Temperature, °F	200	300	400	500	600
LDX 2101	26.9	25.6	24.7	24.7	24.7
304	20.0	18.9	18.3	17.5	16.6
316	20.0	20.0	19.3	18.0	17.0
2205	25.7	24.8	23.9	23.3	23.1

Hot Forming

Heat LDX 2101 uniformly to 1650-2010°F, followed by solution anneal. Dies should have generous radii. This alloy has low strength at high temperatures, hot tearing or surface checking are possible if the initial forging temperature is too high. As with other high chromium alloys, LDX 2101 can be sensitive to coarse grinding or machining marks on the part to be formed. A rapid heat-up rate is desirable. This alloy has very low strength at the annealing temperature, so the work-piece should be well supported in the furnace.

Cold Forming

LDX 2101 stainless can be formed and cold worked using techniques and designs similar to the basic austenitic stainless steel grades. However, due to higher strength and slightly lower ductility, bend radii must be more generous than those used for austenitic materials. Power requirements for forming operations will be greater due to the higher yield strength of LDX 2101 stainless as compared to standard austenitic stainless. LDX 2101 stainless plate can normally be press brake bent over a radius equal to twice the plate thickness. As with other stainless and nickel alloys, bending over a sharp male die may cause the material to crack. Annealing may be required after 25% cold deformation.

Heat Treatment

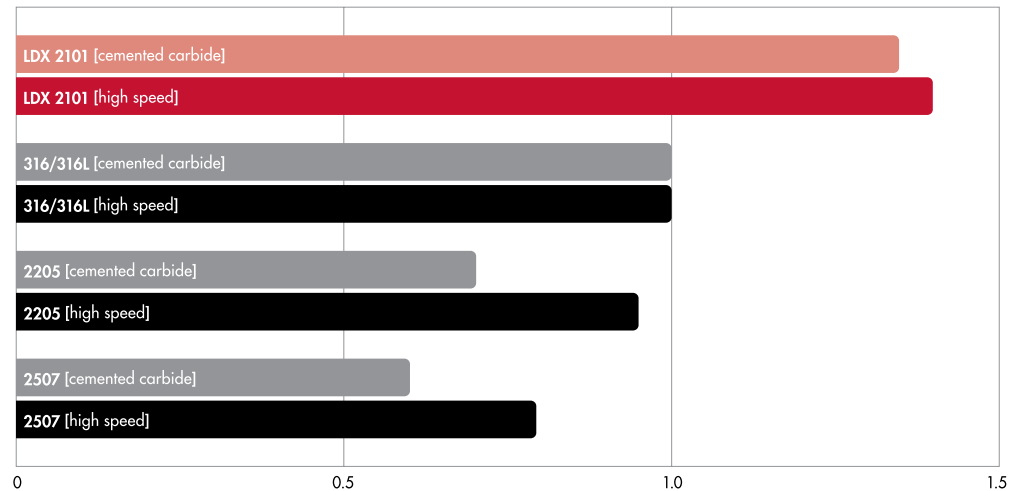
Solution annealing is performed in the range 1870-1975°F, followed by water quench or rapid cooling by other means. A rapid heat-up rate is desirable. This alloy has very low strength at the annealing temperature, so the workpiece should be well supported in the furnace. Hold at temperature at least 10 minutes, or 30 minutes per inch of thickness, followed by a water quench. Furnace cooling of LDX 2101 stainless is not recommended, and may result in unacceptable mechanical and corrosion properties.

Tube Bending & Rolling

It is suggested that LDX 2101 stainless tubes be bent to no tighter than a radius of 2 times the tube's outside diameter (O.D.). This is a minimum inside radius of 1½ times O.D., and a minimum centerline-to-centerline leg spacing of 4 times O.D. Unlike copper alloy or titanium tubes, duplex stainless tubes may be rolled to the full thickness of the tubesheet. No provision need be made for staying back from the inside face of the tubesheet. Grooving the tubesheet hole will not increase the pull-out strength of the rolled-in tube. High strength stainless steels do not flow into the grooves when rolled. LDX 2101 stainless tubes may be expanded using 3, 4 or 5-roller expanders. Selection of the number of rolls is largely a matter of personal preference. However, 5-roller expanders tend to be more forgiving when operator skills vary.

## Machining

Duplex stainless steels are generally more difficult to machine than austenitic stainless steels such as 316/316L, due to higher hardness. However, LDX 2101 has shown excellent machining properties. Because of its machinability, LDX 2101 may be considered for applications such as tube sheets, replacing the special machining grade of austenitic stainless normally used. The machinability index for LDX 2101 is shown below.



## Welding Consumables Chemical Composition, %

	Cr	Ni	Mo	Mn	N	C
GMAW [BARE WIRE]	23.5	7	0.3	1	0.14	0.02
GTAW [BARE WIRE]	23.5	7	0.3	1	0.14	0.02
SAW [BARE WIRE]	23.5	7	0.3	1	0.14	0.02
SMAW [COVERED ELECTRODE]	24	7	0.4	1.5	0.14	0.04
FCAW [FLUX CORE]	24	9	0.7	1.5	0.14	0.03

## Heat Input

In welding duplex alloys such as LDX 2101 it is desirable to maintain the proper austenite-ferrite balance in the weld metal and in the heat affected zone (HAZ). This is accomplished by using a weld filler metal enriched in nickel, and by control of welding heat input, preheat, and interpass temperature as appropriate.

LDX 2101 should be welded with fairly high heat input, comparable to that used for common stainless, such as 304/304L or 316/316L. Do NOT treat any duplex stainless as though it were a nickel alloy. Low heat input and tiny stringer beads are undesirable when welding a duplex stainless. The welding heat input assists transformation of excess HAZ ferrite back to austenite as the weldment cools. High heat input also minimizes chromium nitride precipitates in the ferrite. The suggested range is 15 to 63.5 kJ/inch. The lower end of this range is used with covered electrodes in the flat position. Higher heat is required for vertical SMAW welds.

Heat input in kJ/inch is calculated:

$$\frac{\text{Voltage} \times \text{Aperage} \times 6}{\text{Travel Speed (inch/minute)} \times 100}$$

The arc should always be struck at a point within the joint itself. An arc scar is essentially an autogenous weld, very rapidly cooled, and may have excessive ferrite. Arc scars on the base metal should be removed by fine grinding.

## Preheating

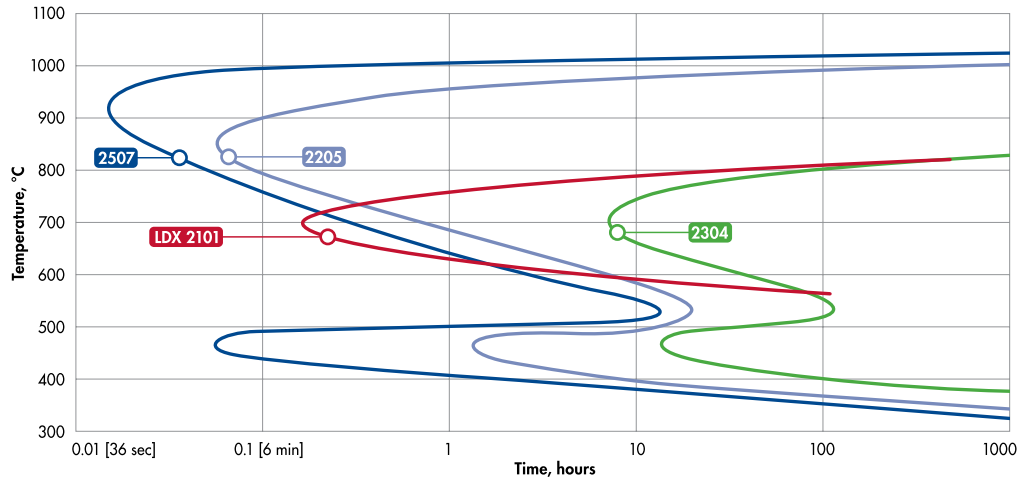
Preheating is not normally done with LDX 2101. Two exceptions are to remove moisture, and when welding very thick plate. If the shop is cool such that condensate may occur, or when welding out of doors in cold weather it may be useful to preheat just to ensure that the metal is dry. Heat very carefully and uni-formly in the weld area, to at least 50°F but no more than 300°F. When heavy plate over 5/8" is to be welded by a method with very low heat input less than 15 kJ/inch, one may wish to preheat 200-300°F. This prevents excessively fast cooling, with its attendant high ferrite content.

**Interpass Temperature**

Weld interpass temperature must not exceed 300°F. Natural conduction of heat away from the weld may be sufficient to control interpass temperature. Balanced welding and working on several welds at the same time may also help. Such measures also improve productivity and reduce distortion. Measure interpass temperature with a contact pyrometer or laser infrared pyrometer. Temperature measuring crayons may contaminate the joint.

**Microstructure**

Duplex alloys are more prone than austenitic stainless to precipitation of phases that reduce ductility and corrosion resistance. These curves illustrate the time-temperature relationships for embrittlement due to sigma formation, and to 885°F embrittlement of the ferrite phase. It is desirable to minimize the amount of time spent in the "red heat" temperature range. LDX 2101 takes significantly longer than 2205, before any harmful phases precipitate.



**Filler Metals**

Enriched nickel weld fillers have been developed to further assure proper phase balance in LDX 2101 stainless weldments. The higher nickel, 7% in bare wire and in covered electrodes, and 9% in flux cored wire, promotes transformation of ferrite to austenite as the weld bead cools. These enriched nickel weld fillers are designated LDX 2101.

Duplex weld fillers such as 2209 or ZERON® 100 X. GTAW wire may also be used to join LDX 2101 base metal. These molybdenum alloyed fillers are more sensitive to sigma phase precipitation and if used, the welding procedures appropriate to 2205 or ZERON® 100 base metals should be followed.

Nickel alloy weld fillers have markedly lower erosion resistance than duplex stainless and should generally be avoided except where required for dissimilar metal welds. High columbium levels in weld fillers such as ERNiCrMo-3 may deplete nitrogen from the adjacent LDX 2101 base metal.

**Welding Process vs Properties**

Choice of welding process affects impact toughness. In order of increasing impact toughness: SMAW AC/DC, FCAW, SAW (with Flux 805), GMAW argon shielding, GMAW 95%Ar 3%He 2%N<sub>2</sub> shielding, and GTAW.

**SMAW**  
Shielded Metal Arc Welding

LDX 2101 AC/DC enriched nickel covered electrodes should be used with a short arc, or with its coating sliding along the workpiece. A "long arc" or increased gap between electrode and workpiece may result in weld porosity and excessive oxides in the weld. Avoid welding in the presence of direct drafts of air, wind, or fans. Direct Current Reverse Polarity (electrode positive) is preferred. Optimum results are achieved from using amperage in the upper end of the given range. It is advantageous to tack with a somewhat larger gap than might be used for rutile and basic electrodes, to ensure good penetration. Use stringer beads with LDX 2101 AC/DC enriched nickel covered electrodes in the flat position. A slight weave, not exceeding two times the diameter of the electrode, may be used. Weaving is unavoidable in vertical welds. Remove all slag from each filler pass by use of chipping tools, fine grinding or stainless wire brushes. Do NOT use carbon steel brushes!

LDX 2101 covered electrodes must be kept dry to avoid porosity and hydrogen embrittlement of the weld. Store these electrodes in a non-humid environment at 100°F or higher and use while they are still warm, from a heated quiver.

Electrodes which have absorbed moisture may be dried out by baking in an electric oven for about 3 hours at 480°F. If the electrodes are baked too hot or too long, the arc characteristics will change undesirably.

**SMAW**  
Typical Parameters

Electrode Diameter, in	3/32	1/8	5/32
Current, Amperes	50-80	70-110	100-160

**SMAW**  
Typical Weld Bead Properties

Tensile Strength, ksi	0.2% Offset Yield Strength, ksi	Elongation, %	Charpy V Notch, ft-lb	Hardness, Brinell
120	90	25	33*	260

\* @ 68°F

**GMAW**  
Gas Metal Arc Welding

LDX 2101 plate is GMA welded using either the spray arc or pulsed-arc transfer mode. Short circuiting arc transfer is used for welding thin sheets and for out-of-position welding. Pulsing arc transfer provides some of the benefits of spray arc at a lower average heat input, which permits the method to be used in both the horizontal as well as the vertical-up position. The best flexibility is achieved by using pulsed arc and 0.045 inch diameter wire. Heat inputs should be maintained around 20-45 kJ/inch. The upper end of the range is not critical.

Appearance - On duplex stainless the gas metal arc process makes a ropey looking weld bead with a dirty gray oxide color. While unattractive, this is quite normal for GMAW using LDX 2101 wire. Do clean this oxide off between weld passes.

Shielding gas is normally 100% welding grade argon having a nominal purity of 99.996% and a dew point of -77°F, 2% nitrogen may be added. Helium may be added if desired to flatten the bead contour. Argon-25% helium is desirable to get good edge fusion when welding very heavy plate with small diameter wire. A newer gas mixture with desirable characteristics is 95%Ar 3%He 2%N<sub>2</sub>. Do not add oxygen or hydrogen. Oxygen or hydrogen contamination lowers impact toughness in duplex stainless weldments.

**GMAW**  
Typical Parameters

Spray-arc Transfer, 100% Argon shielding at 24-36 SCFH

Electrode Diameter, in	0.035	0.045	0.062
Current, amperes	170-200	180-260	230-350
Voltage, volts	24-28	27-31	26-32

**GMAW**  
Typical Weld Bead Properties

Tensile Strength, ksi	0.2% Offset Yield Strength, ksi	Elongation, %	Charpy V Notch, ft-lb
100	75	30	110*

\* @ 68°F

**SAW**  
Submerged Arc Welding

When sub-arc welding LDX 2101, use Avesta Flux 805. This is a highly basic (Basicity Index 1.7), slightly chromium-compensated agglomerated flux. Do not use acid fluxes meant for 18-8 stainless. Heat inputs in the range 12-50 kJ/inch are preferred.

**SAW**  
Typical Parameters

Spray-arc Transfer, 100% Argon shielding at 24-36 SCFH

Electrode Diameter, in	3/32	1/8
Current, amperes	300-500	400-600
Voltage, volts	28-33	29-34

**SAW**  
Typical Weld Bead Properties

Tensile Strength, ksi	0.2% Offset Yield Strength, ksi	Elongation, %	Charpy V Notch, ft-lb	Hardness, Brinell
110	80	25	100*	260

\* @ 68°F

**FCAW**  
Flux Cored Arc Welding

The enriched nickel flux cored wire developed for use with LDX 2101 is designated FCW-2D LDX 2101. The use of flux cored welding can reduce fabrication costs, as compared to using solid wire. However fabricators should be aware before quoting the job that some end users may not permit flux cored welding of pressure boundary joints.

The preferred shielding gas is Argon 15-25% CO<sub>2</sub> at 40-50 cfh. This mix gives the best results with respect to arc stability, melt pool control at a minimum of spatter. It is also possible to use 100% CO<sub>2</sub>. If 100% CO<sub>2</sub> is used, welding voltage should be increased by 2-3 volts to ensure the right arc length.

Use stringer beads with very little weave. Weaving will tend to trap slag at the edges of the bead. Allow the metal to cool down below 300°F between passes. Remove all traces of flux before placing the equipment in service.

**FCAW**  
Typical Parameters

Typical Parameters with 0.045 inch diameter wire 20-25

	Amperes DCRP (Electrode Positive)	Voltage, volts
Argon 15-25% CO <sub>2</sub> Horizontal Position	150-280	24-32
H-Vertical Position, PC	140-200	23-28

The preferred shielding gas is Argon 15-25% CN<sub>2</sub> at 40-50 cfh (20-25 l/min). This mix gives the best results with respect to arc stability, melt pool control at a minimum of spatter. It is also possible to use 100% CN<sub>2</sub>. If 100% CN<sub>2</sub> is used, welding voltage should be increased by 2-3 volts to ensure the right arc length.

Use stringer beads with very little weave. Weaving will tend to trap slag at the edges of the bead. Allow the metal to cool down below 300°F between passes. Remove all traces of flux before placing the equipment in service.

**FCAW**  
Typical Weld Bead Properties

Tensile Strength, ksi	0.2% Offset Yield Strength, ksi	Elongation, %	Charpy V Notch, ft-lb	Hardness, Brinell
110	85	25	35*	240

\* @ 68°F

**GTAW**  
Gas Tungsten Arc Welding

With GTAW, use straight stringer beads. Limit dilution of the weld bead by LDX 2101 base metal. This is particularly important in tack welding and during the root pass. Insufficient weld filler or too low a heat input both tend to promote high ferrite contents and reduced ductility in the bead. 2% thoriated tungsten electrodes (AWS EWTh-2) are used, with direct current straight polarity (electrode negative). For good arc control, grind the electrode tip to a 30 to 60 degree point with a small flat at the tip. Grind lines should be parallel to the electrode, not circumferential. Finish grind on a 120 grit wheel. Adjust the arc on clean scrap metal, with no scale.

Pipe or tube welding requires purging at about 20-40 cubic feet per hour. Common purge gases are pure argon, or argon-2% nitrogen. Heat input should be 12-50 kJ/inch to ensure sufficient austenite in the finished weld bead.



**GTAW**

Typical Parameters

Weld Wire Diameter, in	3/32	1/8
Direct Current, Straight Polarity (Electrode Negative), Amperes	130-180	160-220
Voltage, volts	16-19	17-20
Shielding Gas* Flow Rate	13-17	—

\* Do not use hydrogen in the torch gas. This may embrittle the weld. Helium additions results in deeper penetration and faster speeds in automatic welding.

Pipe or tube welding requires purging at about 20-40 cubic foot per hour. Common purge gases are pure argon, or argon-2% nitrogen. Heat input should be 12-50 kJ/inch to ensure sufficient austenite in the finished weld bead.

**GTAW**

Typical Weld Bead Properties

Tensile Strength, ksi	0.2% Offset Yield Strength, ksi	Elongation, %	Charpy V Notch, ft-lb
105	80	30	130*

\* @ 68°F

**Dissimilar Metal Welding**

	Carbon/Low Alloy Steel	Austenitic Stainless	Other Duplex Stainless	AL-6XN, Alloy 20, 625, C-276, C22, 686
LDX 2101	E309LMo, E309L*	E316L, E309LMo, LDX 2101	LDX 2101, E2209, ER2209, 2507	686 CPT®, C-276, C22

\*the use of duplex stainless weld metal on carbon steel may result in a weld with a hard, brittle martensitic zone of about Rockwell C35.

**Weld Joint Design**

Compared to 316/316L stainless, duplex weld fillers have reduced fluidity and wetting characteristics. For this reason joints need to be more open at the root. A J-or U-preparation may be needed with LDX 2101 where a V would suffice with carbon steel. Avoid feather-edge roots - these promote high dilution and may result in high FN welds of low toughness. The following are a few suggested joint designs, intended to achieve full penetration welds.

**Square Butt**

Weld Joint Design

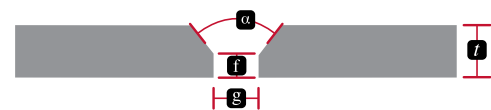
Wall Thickness (t), in	1/8 max
Gap (g), in	1/16 - 3/32



**Single "V" Joint**

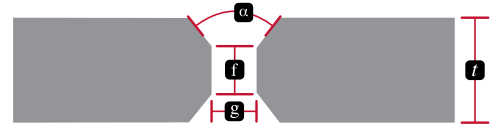
Weld Joint Design

Wall Thickness (t), in	3/8 max
Included Angle (α), °	60-70
Gap (g), in	1/16 - 1/8
Land (f), in	1/32 - 1/16



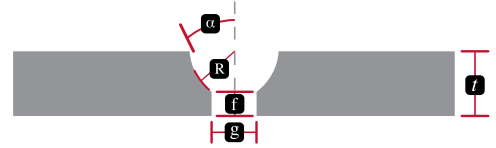
**Double "V" Joint**  
Weld Joint Design

Wall Thickness (t), in	$\geq 1/2$
Included Angle (a), °	60-70
Gap (g), in	$1/16 - 1/8$
Land (f), in	$1/16 - 1/8$



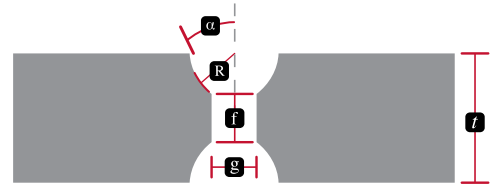
**Single "U" Joint**  
Weld Joint Design

Wall Thickness (t), in	$\geq 3/4$
Included Angle (a), °	15
Gap (g), in	$1/16 - 1/8$
Radius (R), in	$1/4 - 3/8$
Land (f), in	$1/16 - 1/8$



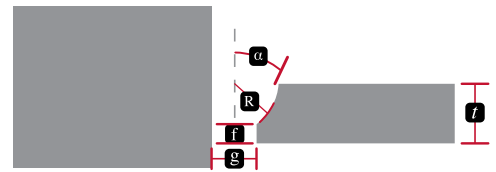
**Double "U" Joint**  
Weld Joint Design

Wall Thickness (t), in	$\geq 3/4$
Included Angle (a), °	15
Gap (g), in	$1/16 - 1/8$
Radius (R), in	$1/4 - 3/8$
Land (f), in	$1/16 - 1/8$



**"J" Groove Joint**  
Weld Joint Design

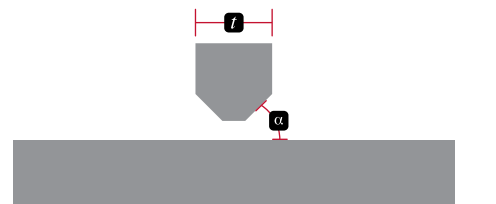
Wall Thickness (t), in	$\geq 3/4$
Included Angle (a), °	15
Gap (g), in	$1/16 - 1/8$
Radius (R), in	$1/4 - 3/8$
Land (f), in	$1/16 - 1/8$



**"T" Joint**  
Weld Joint Design

Thickness (t), in	$\geq 1/4$
Included Angle (a), °	45

For joints requiring maximum penetration. Full penetration welds give maximum strength and avoid potential crevice corrosion sites.



**Openings**  
Weld Joint Design  
Manways, Viewports & Nozzles

Gap (g), in	$1/16 - 1/8$
Land (f), in	$1/16 - 1/8$
Included Angle (a), °	45

For joints requiring maximum penetration. Full penetration welds give maximum strength and avoid potential crevice corrosion sites.



### Repair Welding

Separate procedures should be qualified for weld repair. The critical issue is the total exposure time of the metal to the “red heat” zone. A maximum cumulative time of 20 minutes in the 1100-1500°F range is suggested. After this time the notch impact toughness of the weldment may drop below 50% of the annealed value. This is caused by nitride and intermetallic phase precipitation, which may also lower the corrosion resistance of the weldment. The material generally will retain at least 20 foot-pounds Charpy V-notch impact strength for up to about 30 minutes exposure to about 1300°F.

Weld repair must only be performed with the use of filler metal. That is, a “wash pass” with GTAW torch only is undesirable as it will lead to a high ferrite content in the weld.

### Quality Assurance

It is important to both the fabricator and to the end user that quality requirements for duplex fabrication be both relevant to the service and practical to achieve. Mandatory should be NDT, both visual and radiograph, macro geometry of the weld, tensile test and Charpy V-notch testing. Other testing might include hardness, microstructure, and other NDT such as ultrasonic.

Suggestions: Prior to fabrication a weld procedure should be written and approved by the end user. Both the procedure, and each individual welder’s performance, should be qualified by weldment impact testing as covered by paragraph UHA-51, ASME Section VIII, Division 1. The choice of test temperature should be chosen with the lowest expected service temperature in mind. Location of test specimen is important. Low Charpy values may indicate a high ferrite content, or the presence of sigma phase.

Somewhat questionable are magnetic or metallographic tests for phase balance, and metallography for sigma. The phase balance issue of interest might be local areas of high ferrite, but these will get lost in magnetic measurements of a material that is already 50% ferrite. Agreement among laboratories with respect to ferrite measurement by point count metallographic methods may be only plus or minus 6 Ferrite Number (FN). Metallography for sigma is very subjective, with agreement among laboratories only on the order of a factor of 2. Volume percent of sigma may be less important than particle size. Note that ASTM A 923, Detecting Detrimental Intermetallic Phase, was originally written to ensure that duplex 2205 (S32205) base metal was adequately annealed at the steel mill. It would also be appropriate for 2205 that had been annealed after hot or cold forming. To date it has not been decided how to address LDX 2101 (S32101) and other lean duplex stainless steels in ASTM A 923. A reminder - ASTM A 923 does not address welding and really is inappropriate to use as a quality control specification for weldments.

### Ferrite Measurement

If it is considered important to measure the ferrite level in duplex stainless weldments, a magnetic method is the suggested means. Magnetic measurement of ferrite is expressed as a Welding Research Council Ferrite Number (FN). This is the only agreed upon means of ferrite measurement in duplex stainless weld metal.

There is currently no agreement among laboratories regarding a metallographic method of measuring actual volume percent ferrite in duplex stainless weld metal itself.

The definitive instrument for ferrite measurement in welds is the Magne Gage. With the addition of counterweights it may be used up to 140 FN. At the high ferrite levels of a duplex stainless, Magne-Gage readings are sensitive to vibration. Weld test specimens should be finished smooth with 400 or 600 grit paper, rather than the file finish used for austenitic stainless steels. A contemporary development is the Feritscope®-MP30, calibrated to 80 FN. This pocket-size instrument is completely portable and convenient for shop or field use.

With either instrument the best that can be achieved is to measure the average ferrite level of the region. Given a base metal that is half ferrite, magnetic measurements cannot distinguish any small fully ferritic regions, such as might be present in the HAZ of the more highly alloyed duplex grades.



The Global Leader in Specialty Metals

RA, Rolled Alloys, and ZERON are registered trademarks of Rolled Alloys • FERITSCOPE is a registered trademark of Helmut Fischer GmbH Institut für Elektronik und Messtechnik Corporation • 686 CPT is a registered trademark of Special Metals Corporation

