

## Material Testing Sample Size Requirements

TCR Advanced Engineering undertakes Mechanical Testing, Chemical Analysis, Positive Material Identification, Failure Analysis, Metallography, Corrosion Testing, Non Destructive Testing and Third party Inspection Services.

The following sample requirements will provide optimal sample size for our engineers to conduct the required tests. If your sample size does not meet the requirements listed below, please contact TCR because sub-sized samples can be used or we may have other methods for conducting similar analysis. Sample sizes larger than those listed will not present a problem, but additional machining may be required. The table below is considered as a good reference point for most samples. For special items or if limited amount of material available, please contact TCR.

TYPE OF TESTING	SHEET*	PLATE*	ANGLE	BAR	PIPE	TUBING
Chemical**	2"x2"	2"x2"	2" long	2" long	2" long	2" long
Tensile	2"Wx12"L	Note (1)	18" long	6" long/Note (2)	Note (3)	12" long
Flattening	----	----	----	----	3" full ring	3" full ring
Bend	Note (4)	Note (4)	----	Note (4)	Note (4)	Note (4)
Charpy	----	Note (5)	6" long	9" long	3" long	----
Hardness	2"x2"	2"x2"	2"x2"	2" long	2" long	2" long

### Note:

1. Plate up to 3/4" thick requires 2"Wx18"L; Plate greater than 3/4" thick requires 2"Wx6"L
2. Bar or wire under 1/4" diameter requires 18" long
3. Pipe up to 3/4" wall thickness requires 15" long; Pipe greater than 3/4" wall thickness requires 6" long
4. Requirement depends upon size and specification. We prefer ten inch length.

5. 4"W x 6"L with longitudinal direction noted with 0.1" thickness

Test Procedures	Length	Width	Thickness	Grain
<b>Mechanical Tests</b>				
Tensile Test Wire	Any	*	Any	*
Microhardness using Knoop &Vickers methods	1"	1"	0.030"	*
Rockwell Hardness	1"	1"	0.030"	*
Brinell Hardness	1"	1"	1/4"	*
Plating Hardness	1"	1"	0.001"	*
Plating Thickness	1"	1"	0.001"	
Hydrogen Embrittlement	*	*	*	*
<b>Chemical Analysis**</b>				
Spectrometer	1"	1"	1/8"	*
Atomic Absorption - 1 gram of sample	**	**	**	**
LECO Carbon, Sulfur and Nitrogen - 1 gram of sample	**	**	**	**
Optical Emission Spectroscopy (OES)	Any Size	**	**	**
<b>Metallography</b>				
Microstructure	Any Size	*	*	*
Inclusion Rating	1/2"	1/2"	1/2"	*
Scanning Electron Microscopy (SEM)	Any Size	*	*	
<b>Corrosion Testing</b>				
Salt spray test Panels	3"	8"	*	*

\* Grain direction is very important when submitting sheet or plate for testing. Always mark grain direction with an arrow on the sample.

\*\* When performing chemical analysis only, supply the above referenced size coupon. If other testing is to be performed (i.e. tensile, flattening, etc.), a separate piece for chemical analysis is not needed.

### Wet Chemical Analysis

Metals - 5 grams minimum, 10 grams preferred

Aqueous Samples - 1/2 litre minimum, 1 litre preferred

Solid Particulate Samples - coarse (> 6mm) 1 kilogram minimum, medium (1 to 5 mm) 500 grams minimum, fines (< 1 mm) 100 grams minimum

### Weld Procedure Qualification

The welded test plate should be a minimum of 10 inches wide by 12 inches along the weld, 16 inches along the weld if Charpy V-Notch impacts required.

Pipe qualifications:

\* over 3" nominal diameter O.D. - 1 pipe

\* 2 - 3" nominal O.D. - 2 pipes

\* less than 2" nominal pipe - 3 pipes

\* Charpy V-Notch impacts may require more material depending on pipe size and quantity of impact tests

### Chemical, Micro and IGC ASTM A262 Prac E

Rod less than 10mm dia - 150mm long

Rod more than 10mm dia - 120mm long

Plate - 50mm X 100mm

Pipe - 100 mm long

### Hydrogen-Induced Cracking (HIC) Test, NACE TM0284

To conduct the HIC test, TCR Advanced Engineering requires the following sample sizes:

Plate - 150mm x150mm with rolling direction marked on it

If the plate is more than 80mm thick - 250mm x 250 mm sample size is required

Pipe - upto 2" OD - 200mm long

If the pipe is more than 2" OD pipe - 100mm long sample size is required

Bars - Upto 3" dia - 300mm long

If the Bars are more than 3" dia to 5" dia - 200mm long sample size is required

If the Bars are more than 5" dia - 100mm long sample size is required

Number of pieces to be tested upto 88mm thick/dia - set of 3 pieces to be tested

Number of pieces to be tested more than 88mm thick/dia - 5 pieces to be tested

Time for completion - 2 weeks

### **Sulfide Stress Corrosion Cracking (SSCC), NACE TM0177**

The SSCC tests at TCR Engineering in India are performed routinely for customers using tensile and bent beam specimens. For each stress level and temperature, the following sample size is required:

Plate - 25mmx200mm with rolling direction marked on it

Pipe - 160 long pieces irrespective of dia

Bar - 160mm long piece irrespective of dia

Time for completion 40 working days