

FWT WELD DEVELOPMENT REPORT:

Customer	NEW DYNAMICS		
Customer Contact	Mr Bijender Singh		
Customer P.O. Number	DTG/248. 03.08.22		
Description of Components	Tenneco Rod		
Tests conducted at lab	Prompt Metallurgical Services & FWT		
Tests Conducted on	23.08.22		
Report Document Number	01	Revision Number	00
Total Pages	10	Date Published	24/08/2022
Weld Engineer	Mr. Satesh	Contact No.	9766206538
Email	satesh@frictionwelding.in		

FWT CONTACT DETAILS:

For Additional Information, please contact:

<u>DEPARTMENT</u>	<u>SALES</u>
Address	Survey No. 326, A/P Gauddara, Gauddara Road, Khed Shivapur, District Division – Haveli, District – Pune, 412205 Maharashtra, India.
Mobile	+91 83088 27952
Email	sales@frictionwelding.in
Website	www.frictionwelding.in

This study aims to demonstrate that testing carried out on a New Dynamics project to demonstrate weld strength and integrity was successful.

The parts examined in this report are the NEW DYNAMICS components as per Drawing No.26540008. The following parts were welded.



METHOD:

Feasibility check: Initially, the customer enquires the finished product's specifications for us. If the dimension of the material to be welded is within the capabilities of our current machine, we move on to the next step.

Drawing Reading: The customer offers us the fundamental component design with dimensions as well as the finished product design that he wants us to weld. Now that we are aware of the necessary dimensions and the settings to set on our machine for welding, we can determine whether or not the drawings of the various components provided for the raw materials that need to be welded are adequate.

Reverse Engineering: Here, we start planning from end product and track step by step backwards which helps to start the process from scratch laying the foundation without leaving anything. By understanding the final product and keeping in mind the need for tolerances for further machining process to be carried out we quote for dimensions (via basic calculation) to our customer and demand some changes if necessary.

Process parameters optimization: We set the process parameters guiding the welding process before beginning the weld process. This covers the spindle's rotational speed, soft friction force, friction force, upset force, brake delay time, and welding modes (burn off, time specific, fixed position upset). After we optimise the process parameters by evaluating the required test passing criteria.

Welding process: Here, PIECE 1 is placed at the spindle, and PIECE 2 is placed at the clamp. Then we check to see if both clamps were applied correctly without leaving an overhang. Following that, the welding procedure is carried out flawlessly by the machine.

Post process inspection: We perform some GD&T testing when the welding is finished. We send the finished goods to our customer after verifying the specifications.

The Weld was carried out on a FWT 15 Ton direct drive Friction Welding Machine using the baseline parameters as below

Weld Speed: 1700 rpm, Weld Load: 18.7kg.mm2

PROCESS PARAMETERS:

	1 st Side Weld		2 nd Side Weld
Job Description	Teneco rod	Job Description	Teneco Rod
Material to be welded	EN8D to C40	Material to be welded	EN8D to C40
Welding length Tube	303.2mm	Welding length Tube + Piston Post	357.40mm
Welding length Piston Post	62.5mm	Welding length Stem End	105.20mm
Total Length	365.5mm	Total Length	462.60mm
Final Length	357.4mm	Final Length	455.60mm
Loss Actual Measured	8.1mm	Loss Actual Measured	07.00mm
Shrinkage Range	7mm - 9mm	Shrinkage Range	7mm - 9mm
Soft Friction time T1A	1sec	Soft Friction time T1A	1sec
Friction time T1B	1.8 sec	Friction time T1B	1.8 sec
Burn Off	5.0 – 5.3	Burn Off	5.2 – 5.3
Brake Delay	0.1 sec	Brake Delay	0.1 sec
Upset Delay	0.8 sec	Upset Delay	0.8 sec
Upset Delay	2.0 sec	Upset Delay	2.0 sec
Soft Friction Pr. 5.6kg.mm ² (P1)	21 bar	Soft Friction Pr. 5.6kg.mm ² (P1)	21 bar
Friction Pr. 9.4 kg.mm ² (P2)	35 bar	Friction Pr. 9.4 kg.mm ² (P2)	35 bar
Upset Pr. 18.7kg.mm ² (P3)	70 bar	Upset Pr. 18.7kg.mm ² (P3)	70 bar
Feed (mm/min)	6.4/6.8/9.9	Feed (mm/min)	6.4/6.8/9.9
RPM	1700	RPM	1700
Run out	0.2mm-0.4mm	Run out	0.2mm-0.4mm

TENSILE TESTING:



Fig 2: Before Tensile Test of the Specimen



Fig 3: After Tensile Test of the Specimen

TEST REPORT:



FRICTION WELDING TECHNOLOGIES PVT. LTD

Unit No. 9 & 10, Shivkamal Industrial Estate, S. No. 78/1/1, NDA Road, Shivane, Pune 411023 Cont. No. 020-25293123

TENSILE TEST REPORT

Machine Model	: TUE-C-400	Test File Name	: New Dynamic Job No.02 17.08.Utm
Machine Serial No	: 2018/268	Date	: 17/08/2022
Customer Name	: New Dynamic	Customer Address	: Plot No. 265, Sector-6, IMT, Manesar Gurgaon Haryana
Order No.	: Job No.2	Test Type	: Tensile
Lot No.	: -	Heat No.	:

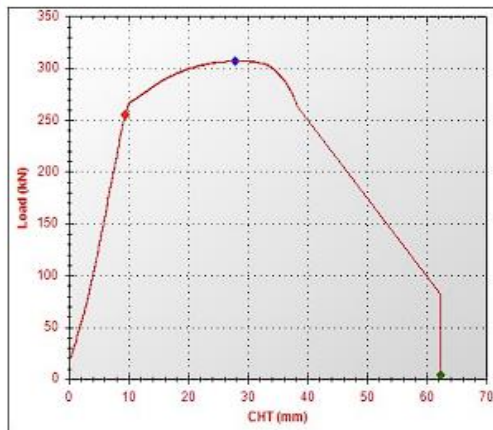
Input Data

Specimen Shape	: Hollow Round
Material Type	: C40 TO EN8D
Specimen Description	:
Specimen Inner Diameter	: 17 mm
Specimen Outer Diameter	: 25.5 mm
Gauge Length For % Elogation	: 456.4 mm
Pre Load Value	: 0 kN
Max. Load	: 400 kN
Max. Elongation	: 200 mm
Specimen Cross Section Area	: 283.725 mm ²
Final Specimen ID	: 14.88 mm
Final Specimen OD	: 20.8 mm
Final Gauge Length	: 483.2 mm
Final Area	: 165.9 mm ²

Output Data

Load At Yield	: 254.96 kN
Elongation At Yield	: 9.450 mm
Yield Stress	: 898.617 N/mm ²
Load at Peak	: 306.780 kN
Elongation at Peak	: 28.040 mm
Tensile Strength	: 1081.259 N/mm ²
Load At Break	: 3.960 kN
Elongation At Break	: 62.350 mm
Breaking Strength	: 13.957 N/mm ²
% Reduction Area	: 41.53 %
% Elongation	: 5.87 %

Load Vs. Cross Head Travel


 Tested By **Amit**

 Remark **Sample Broken in Tube with parent Material**

MACROSCOPIC IMAGING:

The resulting weld was then sectioned, polished and etched to allow the weld and HAZ to be seen. Following this the sample underwent, macroscopic imaging, microscopic imaging, Hardness scanning and bend testing enabling analysis of the weld quality.



Fig 6: Macro

Macro Examination:

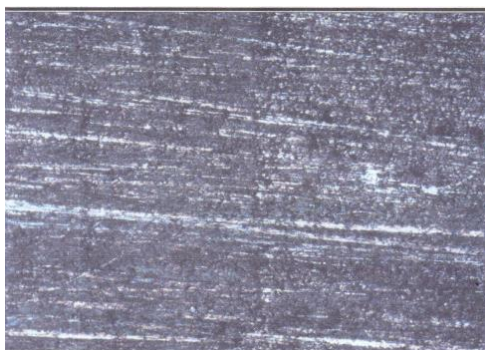
Mag: 1x

Observation: Macro examination of the specimen did not reveal any crack or other defects. Observed complete weld fusion in all examined areas.

Micro Examination:

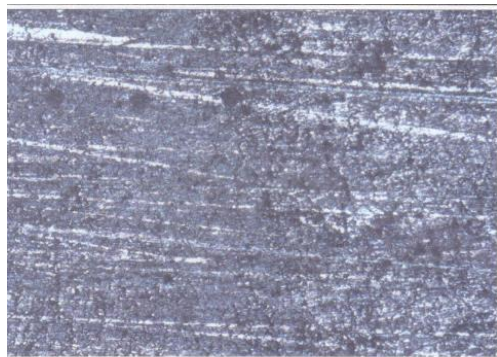
Mag: 100x

Observation: Micro examination of the specimen did not reveal any micro crack or other defects. Observed complete weld fusion in all examined areas.



Side : 100 X

100x Magnification



Middle : 100 X

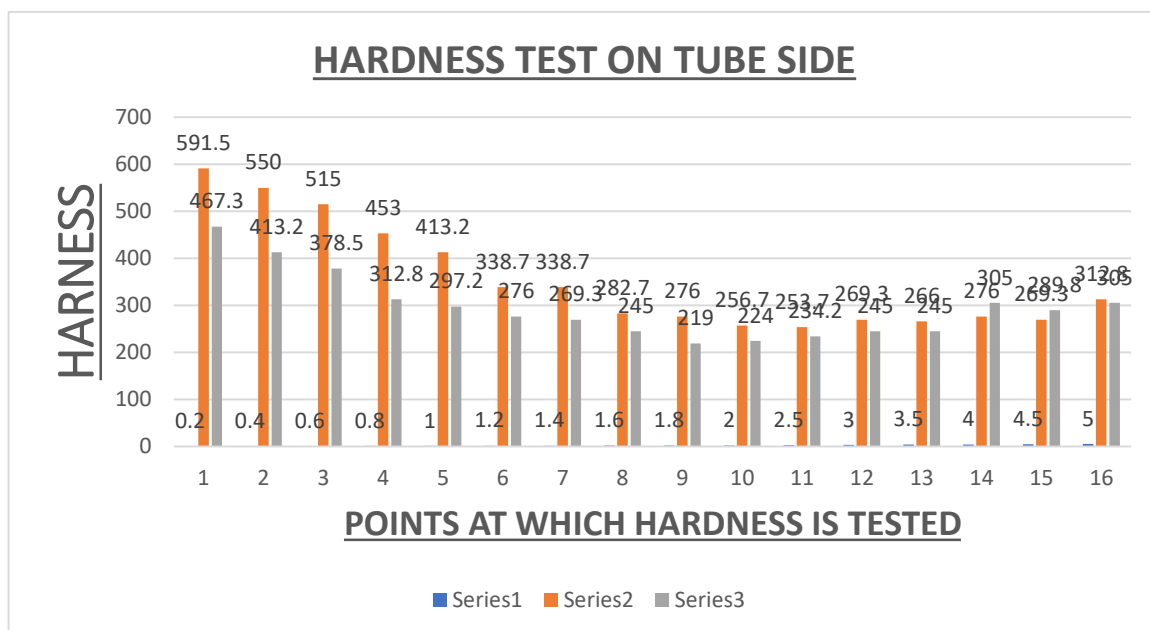
100x Magnification

HARDNESS SCAN:

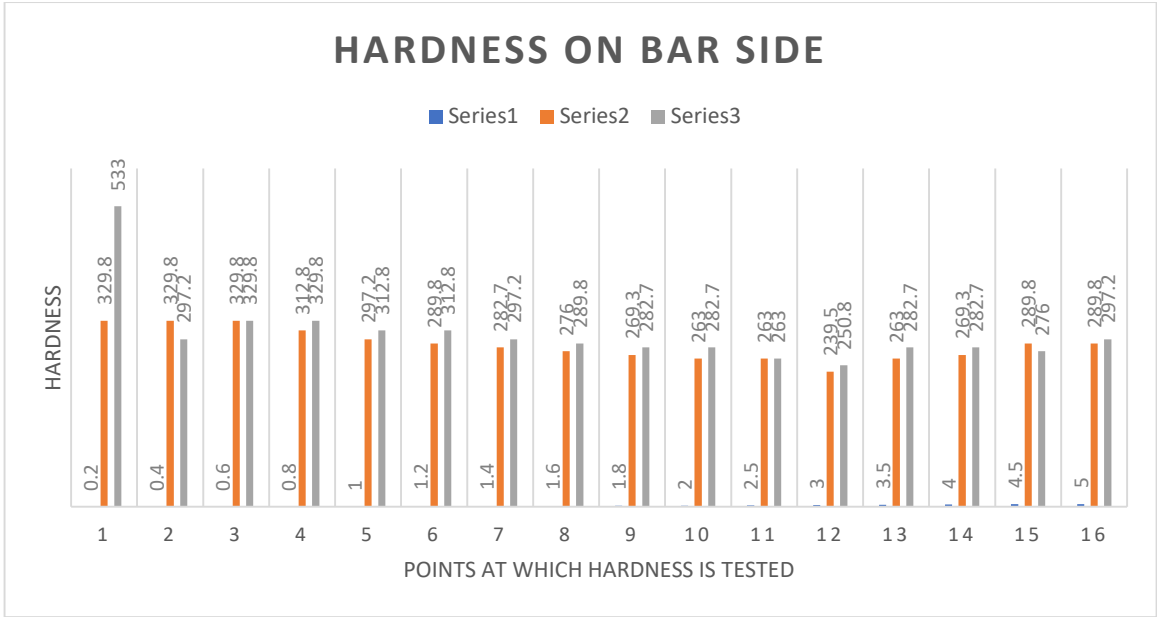
The specimen underwent the Micro Vickers Hardness Test on both its inner and outer surfaces. For the first 2 cm on either side, at 0.2mm intervals, and from 2 to 5 cm also on the wither side, at 0.5mm intervals.

Micro Vickers Hardness: The hardness was measured along straight line, parallel to tube axis, at 0.1mm from the tube's inner and outer diameter. The hardness indentations were made at every 0.2mm at a distance of -2mm to 2mm from the centre of the weld and every 0.5mm at distance from -5mm to -2mm and from 2mm to 5mm from the centre of the weld. (Total length is 10mm)

	<u>IDENTIFICATION</u>	<u>BAR</u>	<u>TUBE</u>
1	Micro Hardness on parent material (HV1)	262.9	297.2
2	Micro Hardness at HAZ (HV1)	OD-329.8, ID-533	OD-591.5, ID-467.3
3	Depth of H.A.Z (mm)	2.5mm	2.8mm
4	Hardness on Weld Section	498.5HV1	



GRAPHICAL REPRESENTATION OF HARDNESS ON THE TUBE SIDE



GRAPHICAL REPRESENTATION OF HARDNESS ON BAR SIDE



TC-6811

PROMPT METALLURGICAL SERVICES

Address : Survey No. 36, Hissa No. 1/3/1,

Between Khedekar Industries & Canara Bank, Narhe, Pune - 411041.

Mobile: 8149024626, 9850149329, 9850273858

Website : www.promptpune.com | Email : pms.vvraje@gmail.com / promptmetallurgicals-services@gmail.com

Scope : **Chemical Testing** - Optical Emission Spectrometer (Steel, Aluminium & its Alloys, Copper & its Alloys)**Mechanical Testing** : Hardness Test, Micro Hardness Test, Metallography Test, Tensile Test, Bend Test

F / 7.8 / 11	Test Report	(Ferrous Metals & Alloys)	
Work Order No.	13532	Page No.	1 of 1
Test Report No / Date	ULR - TC681122000003564F / 06-09-2022	Challan No.	GDN - 22230184
Date of Performance	05-09-2022	Date of Receipt	03-09-2022
Customer Name & Address	M/s. Friction Welding Technologies P. Ltd. , S.no.326,A/P. Gauddara Road,Khed Shivapur,Div.Haveli,Pune 412205. Mo.9766206538.		
Customer's Data	Part Name - New Dynamaic : Development Job (Friction Welding Job)		
Condition of the sample	Satisfactory	Temp.	25°C
Specifications	---		
Methods Used	Hardness (IS : 1501 - Part 1 - 2020).		

I	Mechanical Testing : Hardness : New Dynamaic				
Hardness On Weld Section At Center - 498.5 HV 1					
		On Tube side		On Bar side	
Sr. No.	Distance in mm	Hardness at 0.1 mm from OD (HV1)	Hardness at 0.01mm from ID (HV1)	Hardness at 0.1 mm from OD (HV1)	Hardness at 0.01 mm from ID (HV1)
	HAZ	2.8 mm		2.5 mm	
0	On Weld	498.5 HV1			
1	0.2	591.5	467.3	329.8	533
2	0.4	550	413.2	329.8	297.2
3	0.6	515	378.5	329.8	329.8
4	0.8	453	312.8	312.8	329.8
5	1.00	413.2	297.2	297.2	312.8
6	1.2	338.7	276	289.8	312.8
7	1.4	338.7	269.3	282.7	297.2
8	1.6	282.7	245	276	289.8
9	1.8	276	219	269.3	282.7
10	2.0	256.7	224	263	282.7
11	2.5	253.7	234.2	263	263
12	3.0	269.3	245	239.5	250.8
13	3.5	266	245	263	282.7
14	4.0	276	305	269.3	282.7
15	4.5	269.3	289.8	289.8	276
16	5.0	312.8	305	289.8	297.2


REMARK :

Observation given only .

(Statement of the remark is based on the specification provided by the Customer)

Tested By : LAL / VVR

End Of Report



V. V. Raje / L. A. Kondhe
Authorised Signatory
(Terms and Conditions Overleaf)

BEND TEST:

3-point bend test was conducted on the specimen.

Requirement: On both sides of the weld, the sample length must be the same. The accompanying data indicates that the strips made for ROD OD 25.5 have a thickness of 4 and a width of 6.5.

Test were conducted as per the requirements mentioned above.



Fig 11: Bend Tested Specimen-1 Before

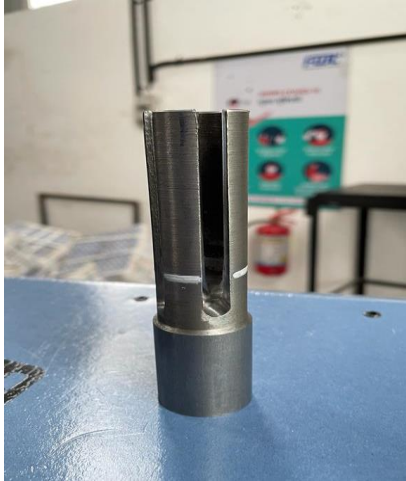


Fig 12: Bend Tested Specimen-1 After

Sample ID	Length (mm)	Width (mm)	Thickness (mm)	Angle of Bend (Deg)	Observation
B1	121.5	6.5	3.07	61 ⁰	No Cracks Observed
B2	121.5	6.5	3.07	57 ⁰	No Cracks Observed
B3	121.5	6.5	3.07	83 ⁰	No Cracks Observed
B4	121.5	6.5	3.07	63 ⁰	No Cracks Observed

Result: Bend Test Found Satisfactory. As per mentioned in the quotation the bend test to be conducted until the specimen is bent over 60⁰.

PETAL TEST:



Before Petal test



After Petal Test

Remark: Petal test was conducted, bending 2 strips inwards and 2 strips outwards. The bend was done up to 90 degrees. No cracks were observed in the weld section.

CONCLUSION:

The quotation's tests were all accurately carried out. The outcomes met the specified parameters and were satisfactory. Based on the results from the test undertaken, the weld has a good strength, higher hardness than the parent material and the weld is uniform throughout the faying interface without cracks and pores.

RECOMMENDATIONS:

None.

Signed:

Name	Position	Signed

Thank You.