

FWT WELD DEVELOPMENT REPORT:

Customer	KARTHIGEYA MOULDS		
Customer Contact	Mr. Azhruddin		
Customer P.O. Number	- (Free of Cost)		
Description of Components	SA IMP, IMPELLER, SPINTUBE		
Tests conducted at lab	FWT		
Tests Conducted on	20.09.22		
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The parts examined in this report are the Karthigeya Moulds components as per Drawing No. KMIF001. The following parts were welded.

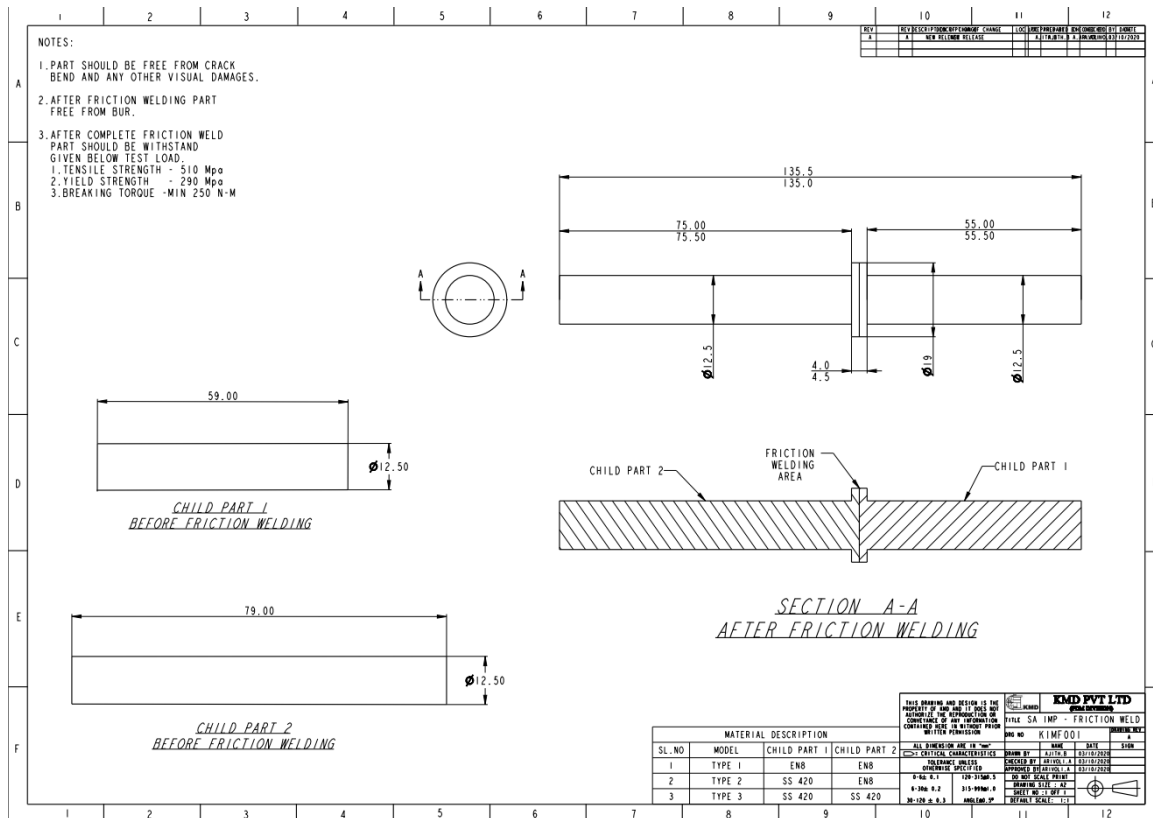
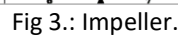
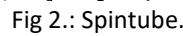


Fig 1.: SA IMP Drawing.



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.

PROCESS PARAMETER:

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: 26.4 kg.mm2

Job Description	SA IMP
Material to be welded	EN8 to SS420
Welding length Tube (mm)	89.6
Welding length Piston Post (mm)	62.5
Total Length (mm)	152.1
Final Length (mm)	140.5
Loss Actual Measured (mm)	11.6
Shrinkage Range (mm)	10 – 12
Soft Friction time T1A (mm)	0.8
Friction time T1B (mm)	3.3
Burn Off (mm)	7.4
Brake Delay (mm)	0.1
Upset Delay (mm)	0.6
Upset Delay (mm)	2.0
Soft Friction Pr. 7.3 kg.mm2 (P1)	11
Friction Pr. 18.0 kg.mm2 (P2)	27
Upset Pr. 26.4 kg.mm2 (P3)	40
Feed (mm/min)	6.4/6.8/9.9
RPM	1700
Run out (mm)	0.4 - 0.5
Flash Diameter (mm)	19.0 – 20.2
Flash Length (mm)	8.7 – 9.2

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: 14.5 kg.mm² for spintube and 25.8 kg.mm² for impeller.

Job Description	IMPELLER	Job Description	SPINTUBE
Material to be welded	SS420 to EN8	Material to be welded	EN8D to SS410
Spindle Side Length (L1)	75.8	Spindle Side Length (L1)	83.2
Slider Side Length (L2)	129.5	Slider Side Length (L2)	73.0
Total Length = (L1 + L2)	205.3	Total Length = (L1 + L2)	156.2
Final Length (mm)	196.0	Final Length (mm)	148.6
Loss Actual Measured (mm)	9.3	Loss Actual Measured (mm)	7.6
Shrinkage Range (mm)	7.3 – 12	Shrinkage Range (mm)	7.9
Soft Friction time T1A (sec)	1.9	Soft Friction time T1A (sec)	0.9
Friction time T1B (sec)	2.8	Friction time T1B (sec)	2.4
Burn Off (sec)	6.8	Burn Off (sec)	5.1
Brake Delay (sec)	0.1	Brake Delay (sec)	0.1
Upset Delay (sec)	0.6	Upset Delay (sec)	0.8
Upset Delay (sec)	2.0	Upset Delay (sec)	2.0
Soft Friction Pr. 7.5 kg.mm2 (P1)	28	Soft Friction Pr. 4.5 kg.mm2 (P1)	18
Friction Pr. 18.1 kg.mm2 (P2)	70	Friction Pr. 8 kg.mm2 (P2)	30
Upset Pr. 25.8 kg.mm2 (P3)	100	Upset Pr. 14.5 kg.mm2 (P3)	56
Feed (mm/min)	6.4/6.8/9.9	Feed (mm/min)	6.4/6.8/9.9
RPM	1700	RPM	1700

TENSILE TESTING:



Fig 4: Tensile Test Specimen Before



Fig 5: Tensile Tested Specimen After

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	: KMD 07.09.Utm
Machine Serial No	: 2018/268	Date	: 07/09/2022
Customer Name	: Karthigeya Moulds & Dies Pvt Ltd	Customer Address	: Plot No. 148, 12th main road, Sidco industrial Estate Thirumudivakkaram 600-0
Order No.	: Doc. No.906 Date 25.08.2022	Test Type	: Tensile
Lot No.	:	Heat No.	:

Input Data

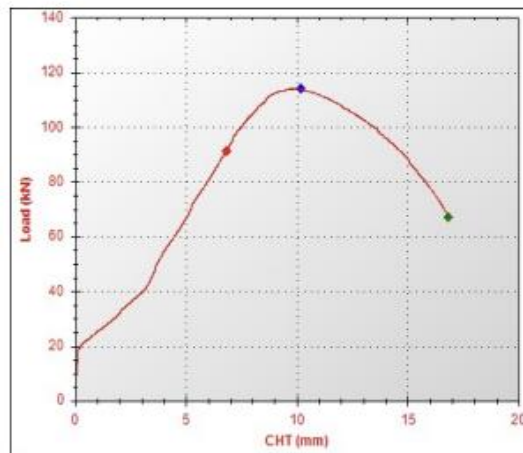
Specimen Shape : Solid Round
 Material Type : SS420 TO EN8
 Specimen Description : Tensile Strength 510 Mpa
 Yield Strength 290 Mpa

Specimen Diameter : 12.5 mm
 Gauge Length For % Elongation : 141.8 mm
 Pre Load Value : 0 kN
 Max. Load : 400 kN
 Max. Elongation : 200 mm
 Specimen Cross Section Area : 122.718 mm²
 Final Sp Diameter : 7.16 mm
 Final Gauge Length : 152 mm
 Final Area : 40.26 mm²

Output Data

Load At Yield : 91.24 kN
 Elongation At Yield : 6.830 mm
 Yield Stress : 743.491 N/mm²
 Load at Peak : 114.160 kN
 Elongation at Peak : 10.190 mm
 Tensile Strength : 930.260 N/mm²
 Load At Break : 67.080 kN
 Elongation At Break : 16.850 mm
 Breaking Strength : 546.617 N/mm²
 % Reduction Area : 67.19 %
 % Elongation : 7.19 %

Load Vs. Cross Head Travel



Tested By : Rishikesh

Remark : Sample broken in SS material

IMPELLER SHAFT



Fig 6.: Before Tensile Test



Fig 7.: After Bend Test



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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	: Karthigeya 20.09.Utm
Machine Serial No	: 2018/268	Date	: 20/09/2022
Customer Name	: Karthigeya Moulds & Dies Pvt Ltd	Customer Address	: Plot No. 148, 12th main road, Sidco industrial Estate Thirumudivakkaram 600-0
Order No.	: KMD-2745/Date 14.09.2022	Test Type	: Tensile
Lot No.	: Req Tensile Strength:510Mpa, Req. Yield Strength:290Mpa		:

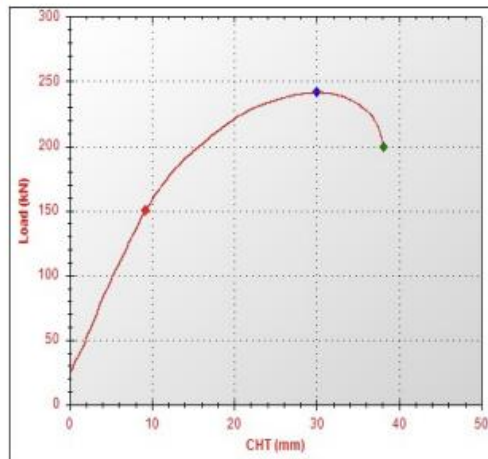
Input Data

Specimen Shape	: Solid Round
Material Type	: SS420 TO EN8
Specimen Description	: Ø20mm X Ø22mm
Specimen Diameter	: 20 mm
Gauge Length For % Elogation	: 198 mm
Pre Load Value	: 0 kN
Max. Load	: 400 kN
Max. Elongation	: 200 mm
Specimen Cross Section Area	: 314.159 mm ²
Final Gauge Length	: 215.4 mm

Output Data

Load At Yield	: 150.14	kN
Elongation At Yield	: 9.290	mm
Yield Stress	: 477.911	N/mm ²
Load at Peak	: 241.400	kN
Elongation at Peak	: 30.170	mm
Tensile Strength	: 768.401	N/mm ²
Load At Break	: 199.100	kN
Elongation At Break	: 38.130	mm
Breaking Strength	: 633.756	N/mm ²
% Elongation	: 8.79	%

Load Vs. Cross Head Travel



Tested By **Rishikesh**

Remark **Sample Broken in EN8 material**

SPINTUBE



Fig 8.: After Tensile Test



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	: Karthigeya Job 01.Utm
Machine Serial No	: 2018/268	Date	: 20/09/2022
Customer Name	: Karthigeya Moulds & Dies Pvt Ltd	Customer Address	: Plot No. 148, 12th main road, Sidco industrial Estate Thirumudivakkaram 600-0
Order No.	: KMD-2745/Date 14.09.2022	Test Type	: Tensile
Lot No.	: Req Tensile Strength: 510Mpa, Req. Yield Strength: 290Mpa		:

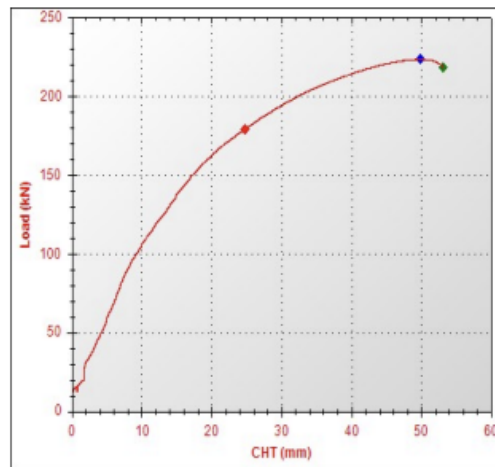
Input Data

Specimen Shape	: Hollow Round
Material Type	: SS420 TO EN8
Specimen Description	: Ø31mm X Ø32mm
Specimen Inner Diameter	: 25.4 mm
Specimen Outer Diameter	: 32 mm
Gauge Length For % Elongation	: 147.6 mm
Pre Load Value	: 0 kN
Max. Load	: 400 kN
Max. Elongation	: 200 mm
Specimen Cross Section Area	: 297.540 mm ²
Final Specimen ID	: 21.3 mm
Final Specimen OD	: 31 mm
Final Gauge Length	: 183.85 mm
Final Area	: 398.44 mm ²

Output Data

Load At Yield	: 178.78	kN
Elongation At Yield	: 24.760	mm
Yield Stress	: 600.86	N/mm ²
Load at Peak	: 223.480	kN
Elongation at Peak	: 49.900	mm
Tensile Strength	: 751.092	N/mm ²
Load At Break	: 218.420	kN
Elongation At Break	: 53.140	mm
Breaking Strength	: 734.086	N/mm ²
% Reduction Area	: - - -	%
% Elongation	: 24.56	%

Load Vs. Cross Head Travel



Tested By **Rishikesh**

Remark **Sample broken at Weld Joint**

Shape deviation			
Sr. No.	Designation.	Presence	Absence
1	Axial Misalignment	-	X
2	Angular deviation	-	X
3	Parts Overlaying	-	X
4	Deformation Of workpieces	-	X
Unsatisfactory joint.			
Sr. No.	Designation.	Presence	Absence
1	Interface Defect	-	X
2	Undercut	-	X
3	Inclusions	-	X
4	Cracks	-	X
Microstructure Features			
Sr. No.	Designation.	Presence	Absence
1	Peaks and troughs in hardness	-	X
2	Gross distortion in grain structure	-	X
3	Intermetallic phases	-	X
4	Carbide, oxide, nitride agglomerations in the welding zone.	-	X
Flash Deviations			
Sr. No.	Designation.	Presence	Absence
1	Burr	-	X

REMARK:

None.

CONCLUSION:

Every test was completed in accordance with specifications. The results of the tensile test met expectations. The resulting weld has good strength, is uniform all the way through, and is error-free.

RECOMMENDATIONS:

None.

Signed:

Name	Position	Signed
Mr. Satesh Bangar	Production Manager.	

Thank You.