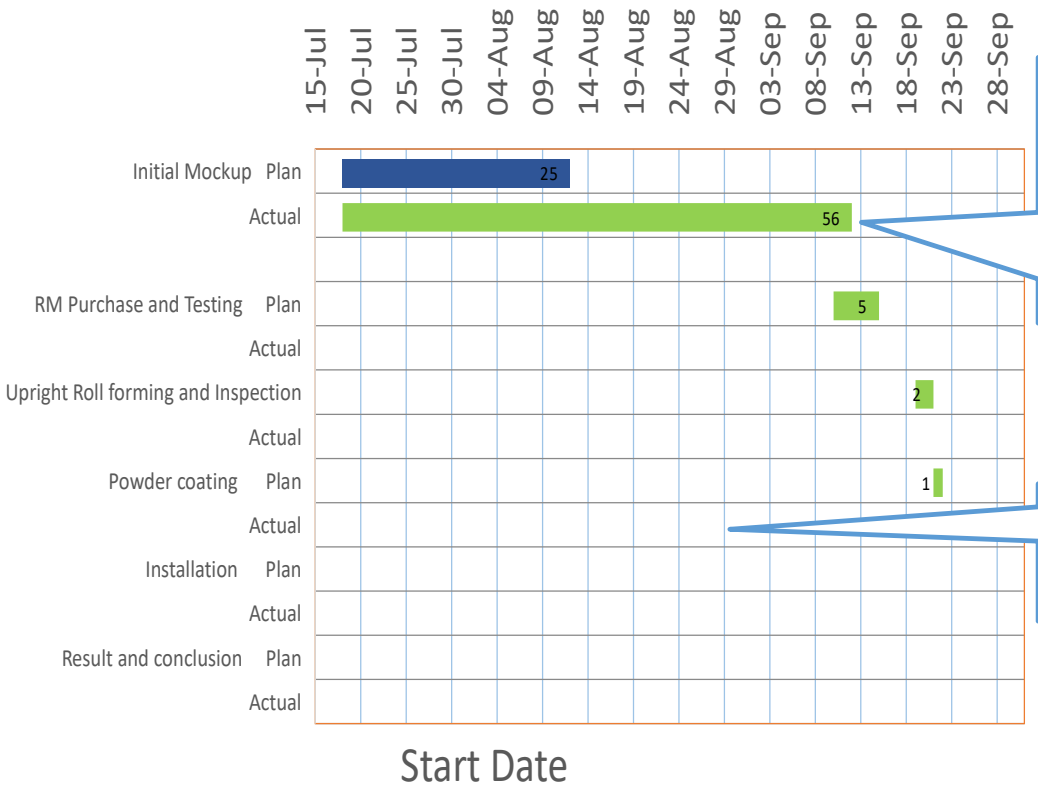
armes maini™

ASRS Mock Up

Time Plan

Revised Time plan for ASRS Mock up



Upright RM YST not meeting the Spec, New Material yet to recieve.

At present Installation done by Internal team to understand the Plum Levels with existing condition

Under discussion with Sales Team to arrange the Skilled Installation team.

Key Findings to Improve

Status as on 08.09.23

- Upright and Beam Raw material tested and found not meeting the Yield strengh Spec Nalrc - 255 N/Sq mm, Raghavendra -265 N/Sqmm.
- In exisitng condition, One rack consists of 5 Frames ,6 Levels of Beams Assembled by Internal team, Floor level adjusted for Plumb correction, Checked and results recorded.

Key Observations or Findings

Sl No	Stage	Findings/ Observations	Action Required	Resp
1	RM	Upright and Beam Raw Material Yield strength not meeting the design spec 275mpa.	Presently RM Supplier supplying as per standard IS 1079 to be changed to meet the AM RM Spec.	Mr Ganesh-Purchase
2	Child part - Upright	Diaginal 9 Hole Position found not ok,61+/-1mm observed upto 62.48mm	Tool correction require Investment on Spares. Corresponding Diagonal Hole pitch to be adjusted in spec.	Mr Hari/Mr Arun
3	Child Part-Bracket	Bracket seating width Dimension 33.7 measuring 32.72 on LH side.	To be Analyzed along with tooling team.	Mr Suresh/ Mr Praveen
4	Child Part-Foot plate	Foot Plate perpendicularity found taper up to 1.5mm	Tacking Fixture corrected and being Monitored.	Mr Bala/Mr Praveen
5	Assembly and Installation	Plumb variation totally depend on Floor level. Plumb adjusted by providing sim plate belowthe foot plate.	Height Adjustable bolts to be provided in Foot plate during next Installation.	Mr Omprakash/ Mr Suresh

Bill of Material

Bill of Material

Material	Material text	Quantity in Nos
1100000651	POW UPRIGHT M 1.6 11992	20
1100000108	GALV LINKBAR M 1.2 1118	10
1200000099	HEXAGONAL HEAD BOLT M8 55	230
1200000102	NYLOCK HEXAGONAL HEAD NUT M8	290
1100000109	GALV DIAGONAL M 1.2 1274	95
1200000127	TUBULAR SPACER M DIA12 X 1.5 X38.5	40
1100001332	POW FOOTPLATE M 5.0 MM (180X85)	20
1200000096	HEXAGONAL BOLT M8X100-8.8 GRD HALF THRD	60
1200000079	HILTI MECHANICAL ANCHOR BOLT M12 100	40
1100000769	POW BEAM M90 1.6 2700	48
1200000115	SAFETY PIN M	96
1100020877	GALV LINKBAR M 1.5 1118	10
1100014994	GALV DIAGONAL M 1.5 1274	95
	BEAM BRACKET LH Coil 3 x178	48
	BEAM BRACKET RH Coil 3 x 178	48
	Foot plate Assembly	20

Raw Material Availability and Quality Status ASRS Mock

Raw Material

Material	Material Text	Qty	RM size	RM Grade	Heat No and Coil No	Qty Required in Kgs	Status	RM test report	Third party test report
1100000651	POW UPRIGHT M 1.6 11992	20	1.6 x 292 mm	S 275 JR	23302314 6044	968	RM received on 27.07.23 RM Yst not meeting the spec 275 mpa.	Avai lable	Available
1100000108	GALV LINKBAR M 1.2 1118	10	1.2 x 90 mm	S250 GD+Z120	Z513982 5958	11.2	RM found ok	Avai lable	
1100000109	GALV DIAGONAL M 1.2 1274	95	1.2 x 90 mm	S250 GD+Z120	Z513982 5958	106	RM Found Ok	Avai lable	Available
1100020877	GALV LINKBAR M 1.5 1118	10	1.5x 90 mm	S250 GD+Z120	C518140 3787	14	RM found Ok	Not Avai lable	Available
1100014994	GALV DIAGONAL M 1.5 1274	95	1.5 x 90 mm	S250 GD+Z120	C518140 3787	133	RM found ok	Not Avai lable	Available
1100000769	POW BEAM M90 1.6 2700	48	1.6 x174 mm	S275 JR	23302314 6048 and 6052	552	RM received on 27.07.23 RM Yst not meeting the spec 275 mpa.	Avai lable	Available
	Beam Bracket LH Beam Bracket RH	96	3 x 178 mm	S235 JR	C49214 5446		RM Found Ok	Avai lable	Available
	Foot Plate 5.0 MM (180 x 85)	20	HR Sheet 5 x 1250 x 2500	SS235 JR	NA		RM found Ok	Not Avai lable	Available
	Foot Plate 3.0 MM	20	HR Sheet 3 x 1250 x 2500	S 235 JR	C493234		RM found ok	Avai lable	Available

Fasteners

Fasteners,Pin and Spacer Status ASRS Mock up

Material	Material Text	Grade	Status	Test report
1200000099	HEXAGONAL HEAD BOLT M8 55	8.8	Available	
1200000102	NYLOCK HEXAGONAL HEAD NUT M8		Available	
1200000096	HEXAGONAL BOLT M8X100-8.8 GRD HALF THRD	8.8	Available	
1200000079	HILTI MECHANICAL ANCHOR BOLT M12 100		Available	Not available
1200000127	TUBULAR SPACER M DIA12 X 1.5 X38.5		Available	Available
1200000115	SAFETY PIN M		Available	Not available

Raw Material Check

RM Inspection Inspection results

Part	Material	Spec Chemical	Supplier TC	Third party	Spec Mechanical	Supplier TC	Third party	Result
POW UPRIGHT M 1.6 11992	S 275 JR	C -0.21 Max Mn-1.5 Max S -0.045 Max P -0.045 Max	C -0.043 Mn -0.23 S -0.007 P -0.016	C -0.058 Mn -0.20 S -0.008 P -0.011	YS-275 mpa min TS-330 mpa min Elongation-19 % min Hard- 55-60 HRB	YS-289 mpa TS-349 mpa Elongation-43 %	YS-255.26 mpa TS-319.69 mpa Elongation-33.10 % Hard – 52-54	**Hardness ,Yst and UTS not ok**
GALV LINKBAR M 1.2 1118	S250 GD+Z120	C -0.20 Max Si-0.60 Max Mn-1.70 Max S -0.045 Max P -0.10 Max	C -0.028 Mn -0.17 S -0.010 P -0.013	C -0.058 Mn -0.19 S -0.009 P -0.012	YS-250 mpa min TS-330 mpa Elongation-19 % min Hard- 55-60 HRB	YS-336 mpa TS-366 mpa Elongation-38.80 %	YS-286.38 mpa TS-355.82 mpa Elongation-31.76 % Hard – 55-56	**Found Ok**
GALV DIAGONAL M 1.2 1274	S250 GD+Z120							
GALV LINKBAR M 1.5 1118	S250 GD+Z120	C -0.20 Max Si-0.60 Max Mn-1.70 Max S -0.045 Max P -0.10 Max	NA	C -0.052 Mn -0.20 S -0.011 P -0.012	YS-250 mpa min TS-330 mpa Elongation-19 % min Hard- 55-60 HRB	NA	YS-268.8 mpa TS-336.97 mpa Elongation-30.50 % Hard – 56-57 HRB	**Found Ok**
GALV DIAGONAL M 1.5 1274	S250 GD+Z120							
POW BEAM M90 1.6 2700	S275 JR	C -0.21 Max Mn-1.5 Max S -0.045 Max P -0.045 Max	C -0.043 Mn -0.23 S -0.007 P -0.016	C -0.056 Mn -0.19 S -0.0079 P -0.013	YS-275 mpa min TS-330 mpa Elongation-19 % min Hard- 55-60 HRB	YS-289 mpa TS-349 mpa Elongation-43 %	YS-248.66 mpa TS-310.73 mpa Elongation-34.68 % Hard – 50-52	**Hardness,yst and uts not ok**
Beam Bracket LH Beam Bracket RH	S235 JR	C -0.17 Max Mn-1.4 Max S -0.045 Max P -0.045 Max	C -0.053 Mn -0.31 S -0.010 P -0.014	C -0.063 Mn -0.20 S -0.011 P -0.014	YS-235 mpa min TS-330 mpa Elongation-19 % min Hard- 55-60 HRB	YS-301 mpa TS-367 mpa Elongation-39 %	YS-264.39 mpa TS-335.56 mpa Elongation-36.24 % Hard – 54-55	**Hardness found not Ok**
Foot Plate 5.0 MM (180 x 85)	SS235 JR	C -0.17 Max Mn-1.4 Max S -0.045 Max P -0.045 Max	NA	C -0.057 Mn -0.31 S -0.010 P -0.014	YS-235 mpa min TS-330 mpa Elongation-19 % min Hard- 55-60 HRB		YS-258.86 mpa TS-345.36 mpa Elongation-33.52 % Hard – 55-56	**Found Ok**
Foot Plate 3.0 MM	S 235 JR	C -0.17 Max Mn-1.4 Max S -0.045 Max P -0.045 Max	C -0.053 Mn -0.31 S -0.010 P -0.014	C -0.060 Mn -0.19 S -0.008 P -0.011	YS-235 mpa min TS-330 mpa Elongation-19 % min Hard- 55-60 HRB	YS-301 mpa TS-367 mpa Elongation-39 %	YS-250.98 mpa TS-350.38 mpa Elongation-34.60 % Hard – 62-64	**Hardness found not Ok**

Raw Material Comparison

Upright Raw Material Comparison wrt various Standards

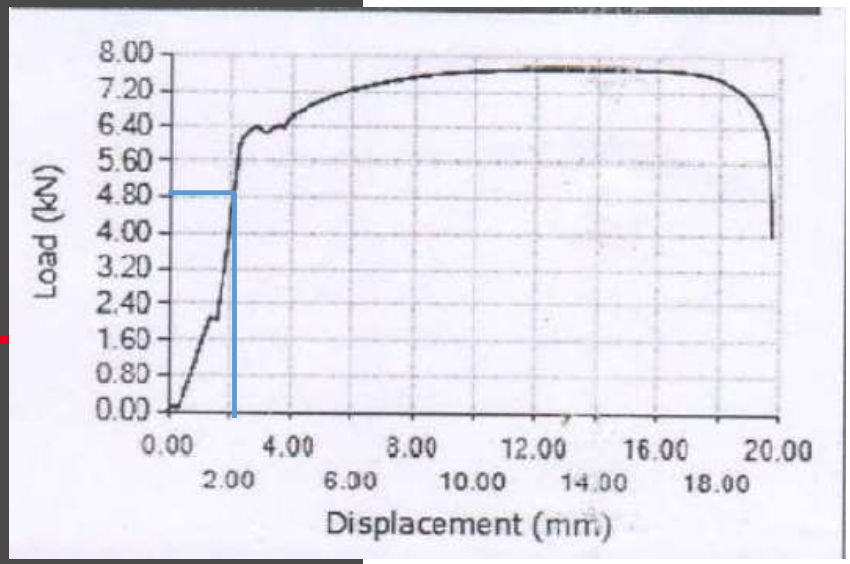
Raw material	Standard	Name as per Standard	Chemical Spec	Mechanical Properties Spec	Remarks
S275 (As per Drawing Spec)	EN 10025	Hot Rolled products of Structural steel	C -0.21 Max Mn-1.5 Max S -0.035 Max P -0.035 Max Cu -0.55 Max	YS-275 mpa min TS-430-580 mpa Elongation-17 Min	Not available in India
IS1079 HRPO HR2 (Present material used for Upright and Beam)	IS1079	Hot Rolled carbon steel sheet and strip	C -0.10 Max Mn-0.45 Max S -0.040 Max P -0.035 Max	TS-420 mpa Max Elongation-25 Min	Supplier can supply Low yield strength material, Yield strength not specified as per standard.
E275 HR	IS2062	Hot rolled medium and high tensile structural steel	C -0.23 Max Mn-1.50 Max S -0.045 Max P -0.045 Max Silicon -0.40 Max Carbon Eq -0.43 Max	YS -275 mpa min TS-430 mpa min Elongation-22 Min	Possibility of powder coating peel off or Adhesion test failure due to scale on its surface in HR. 1.Possibility of Shot Blasting before powder coating to be explored. 2.Derusting process to explored.
Grade 255	IS 5986	Hot Rolled steel products for structural forming and Flanging purposes	C -0.20 Max Mn-1.30 Max S -0.040 Max Carbon Eq -0.42 Max	YS -255 mpa min TS-410-520 mpa min Elongation-17 Min	Recommended by AM Technical team. Availability to be checked.

Observations : Presently Raw material 1079 HRPO HR2 Material used for upright and beam, In last lot yield strength found 255 mpa against spec 275mpa and Elongation 35%. Considering the yst and elongation value, material considerably having less stiffness and tends to bend due to its own weight. Material having yield strength > 275mpa and Optimum elongation near to 17 – 25% will have better stiffness and will result in reducing the buckling effect in uprights.

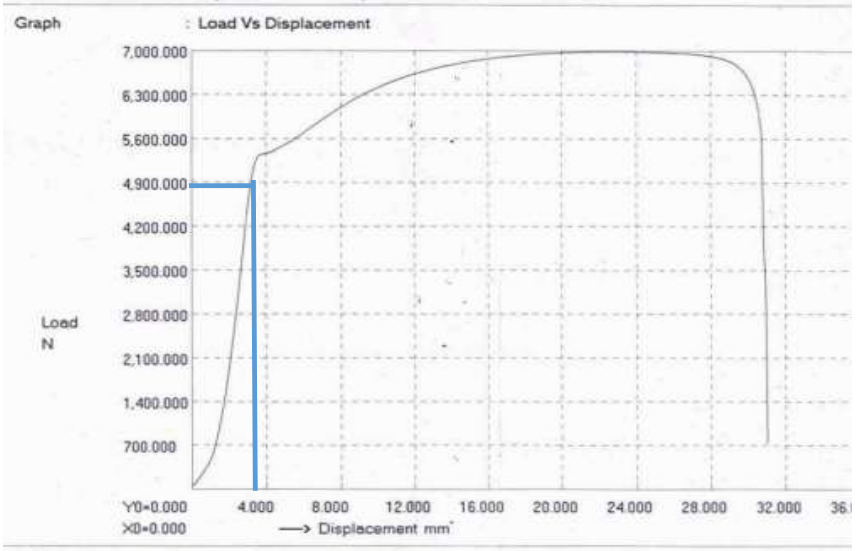
Comparision between JSW and Tata Steel

Raw Material Comparison

Tata Steel



JSW



Tata steel 4.8 KN load the displacement is 2.2mm = 2.18 KN /mm
(0.45 mm /KN)

JSW steel 4.9 KN load the displacement is 3.3mm = 1.48 KN/mm
(0.67 mm/KN)

Result : **Tata steel stiffness found higher compared to JSW.**

Inspection Results

Inspection Results of Child parts ASRS Mock up

Material	Material Text	Inspection report	Observations
1100000651	POW UPRIGHT M 1.6 11992		1) Part found buckling due to self weight while keeping on stand. 2) Bracket seating width Dimension 33.7 measuring 32.72 on LH side. 3) Dia 9 Hole pitch 61+/-1mm dimension measuring up to 62.48mm.
1100000108	GALV LINKBAR M 1.2 1118		Found Ok
1100000109	GALV DIAGONAL M 1.2 1274		Found Ok
1100020877	GALV LINKBAR M 1.5 1118		Found Ok
1100014994	GALV DIAGONAL M 1.5 1274		Found Ok
1100000769	POW BEAM M90 1.6 2700		Twist observed in 4 beams after welding up to 2mm, rectified.
	Beam Bracket LH Beam Bracket RH		Width 34 + 0.5 Undersize up to 33.83 mm RH bracket Hook distance 84 +/-0.2 measuring up to 84.52 LH bracket Hook distance 47+/- 0.2 measuring up to 47.32mm
	Foot Plate 5.0 MM (180 x 85)		Perpendicularity not ok between Base plate and Mounting plate.10 Nos in Tack condition under rectification. 10 Nos welded rejected and New parts made. And Found Ok
	Foot Plate 3.0 MM		

Machine Parameters

Machine Parameters during upright Roll forming

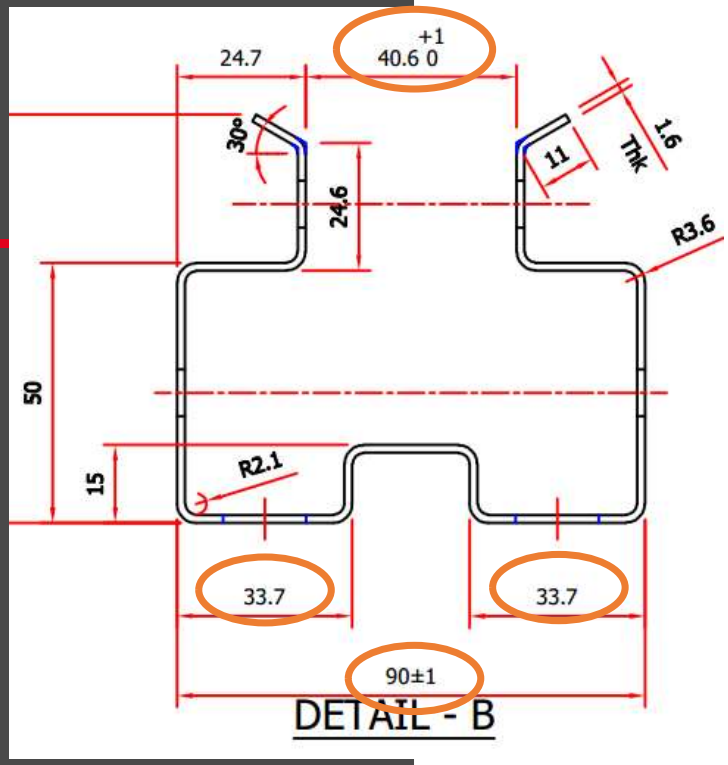
Machine –Omera 200
Tool Shut Height – 372 mm
Tool front distance -107 mm
Pitch setting – 225.2
Feed speed – 70
Strokes/Min – 30
Air pressure – 6.5 bar
Lub oil Pump pressure – 20 bar
Lubrication - Every 12 strokes (B68 Castrol)

Length Cutting press.
Actual Hole -51
Set Hole – 160
Compensation – 385

Forming Roller setting

Roller No	Operator side	Motor side
1	49.7	50.09
2	50.30	47.94
3	50.18	50.38
4	50.28	50.22
5	50.08	50.44
6	50.23	50.47
7	50.6	49.70
8	49.7	50.60
9	48.45	49.36
10	48.57	48.47
11	49.60	49.27
12	48.14	48.00
13	49.31	50.0
14	49.65	49.76
15	49.00	49.53
16	49.0	49.09
17	49.0	48.78
18	48.13	48.31
19	49.0	48.83
20	48.43	48.28
21	48.34	48.57
22	48.38	48.19
23	46.0	48.41
24	47.73	47.58

Inspection Results



Inspection Summary of Upright

Width 90+/-1 mm

Part to Part Overall		Within Part	
Min	89.93	Min Variation	0.22
Max	90.92	Max Variation	0.71
Mean	90.32		
Sigma	0.16		
Cp	2.14		
Cpk	0.83		

Gap 40.60+1 mm

Part to Part Overall		Within Part	
Min	40.18	Min Variation	0.67
Max	41.96	Max Variation	1.68
Mean	41.30		
Sigma	0.51		
Cp	0.33		
Cpk	0.43		

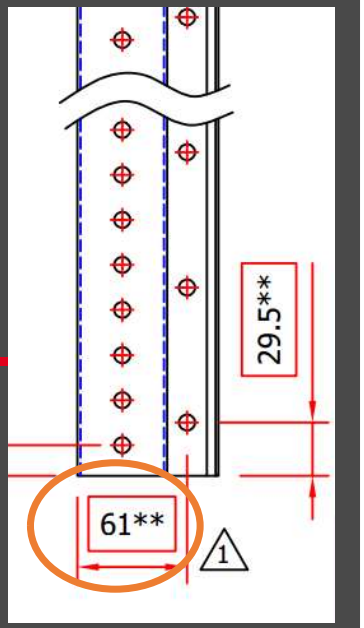
Width 34-0.5 LH Side

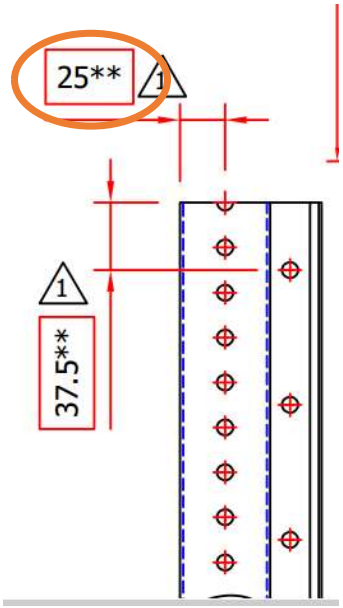
Part to Part Overall		Within Part	
Min	32.01	Min Variation	0.43
Max	32.99	Max Variation	0.92
Mean	32.61		
Sigma	0.22		
Cp	0.39		
Cpk	0.58		

Width 34-0.5 RH Side

Part to Part Overall		Within Part	
Min	33.01	Min Variation	0.49
Max	33.94	Max Variation	0.91
Mean	33.60		
Sigma	0.25		
Cp	0.33		
Cpk	0.45		

Inspection Results





Inspection Summary of Upright

Hole Pitch 61 Dim Left side

Part to Part Overall		Within Part	
Min	60.89	Min Variation	0.32
Max	62.48	Max Variation	1.59
Mean	61.95		
Sigma	0.20		
Cp	1.64		
Cpk	0.86		

Hole Pitch 61 Dim Right side

Part to Part Overall		Within Part	
Min	60.62	Min Variation	0.29
Max	61.49	Max Variation	0.87
Mean	61.10		
Sigma	0.21		
Cp	1.61		
Cpk	0.62		

Hole Pitch 25 Dim Left side

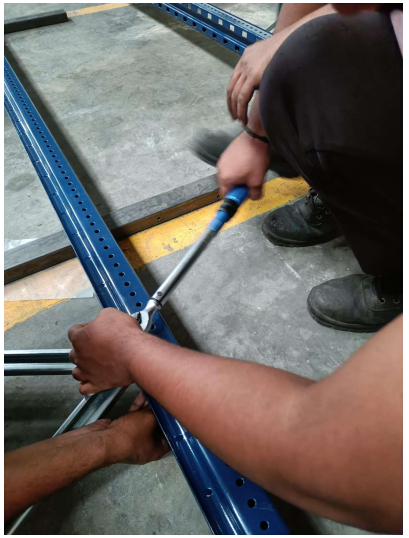
Part to Part Overall		Within Part	
Min	24.51	Min Variation	0.24
Max	25.38	Max Variation	0.82
Mean	24.98		
Sigma	0.19		
Cp	1.80		
Cpk	0.72		

Hole Pitch 25 Dim Right side

Part to Part Overall		Within Part	
Min	23.73	Min Variation	0.14
Max	24.83	Max Variation	1.1
Mean	24.18		
Sigma	0.22		
Cp	1.48		
Cpk	0.66		

Dia 9 Diagonal mounting Hole Pitch checked using 2 pin gauge throughout the Length.

Frame Assembly



- Frame Assembly Completed for 2 nos ,carried out by Internal team,
- One frame Tightening using Torque wrench set for 28.8 Nm.
- One Frame tightening using Battery Gun, Torque observed between

25- 30 Nm.

Key observations:

1. Frame Width found in between 1201mm to -1204mm (61+/-1mm Dimension in upright measured on higher side 62.48mm and 1234 in Diagonal found on Higher side).
2. After frame assembly, During cantilever Holding of Half of its length, Buckling found up to 38mm on one side to 45mm on other side on uprights. (Buckling due to self weight of Upright)

Unit Assembly with 2 Frames

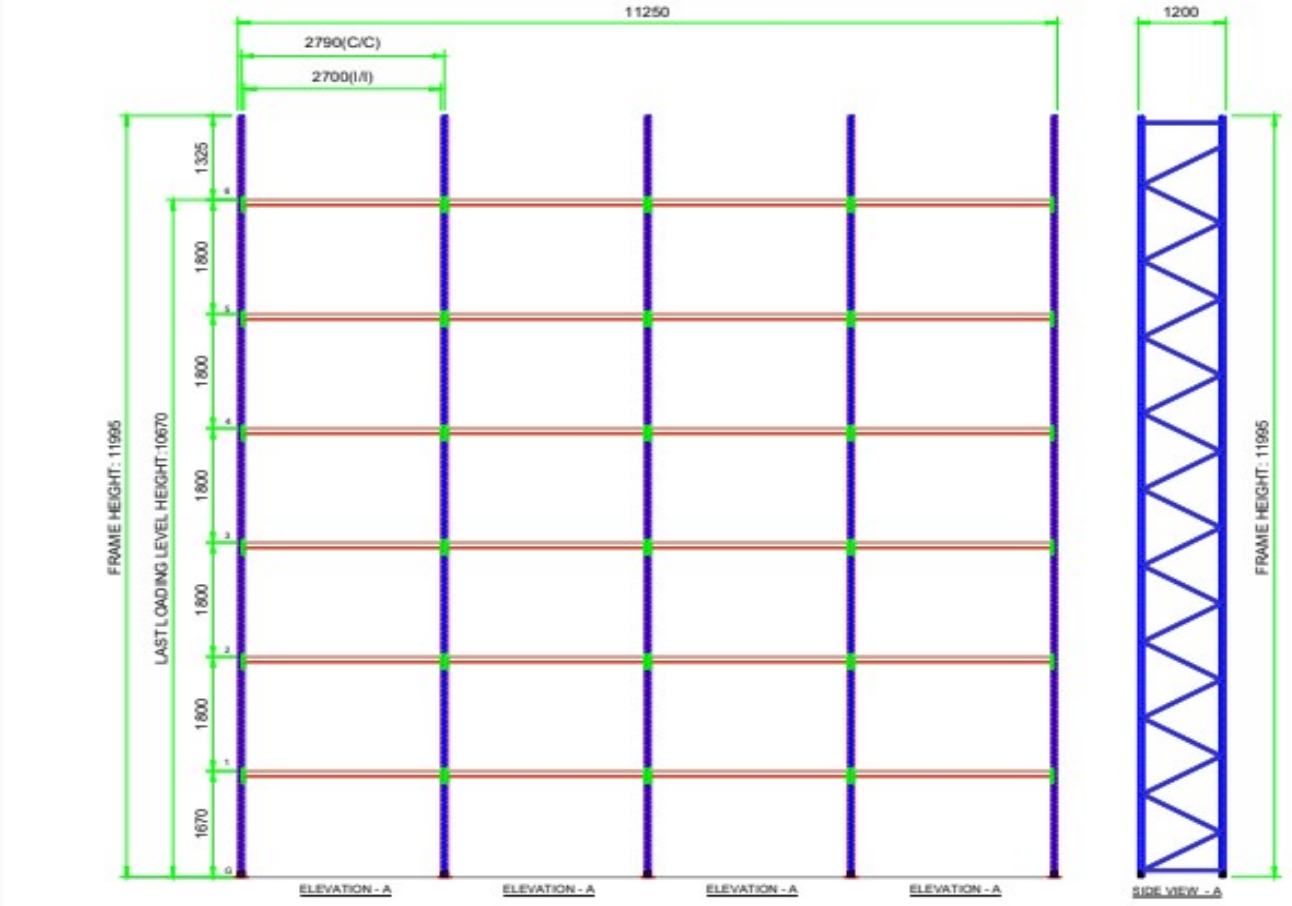
Key Observations

- Unit width found oversize, measuring 2883 to 2887 against spec 2880+/-2mm.
- In the stable position shown in picture, water level difference between front to rear found up to 3mm.
- Diagonal difference between Uprights found to be up to 7mm
- Unit found more flexible

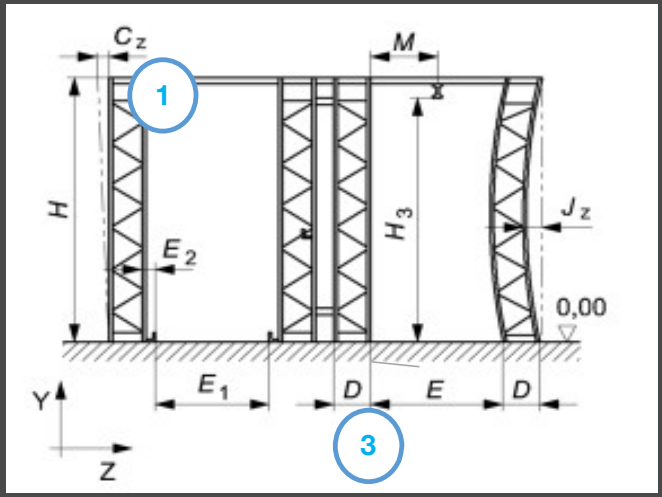
Pre Mock up Assembly and Lifted the Rack to understand the Plumb levels

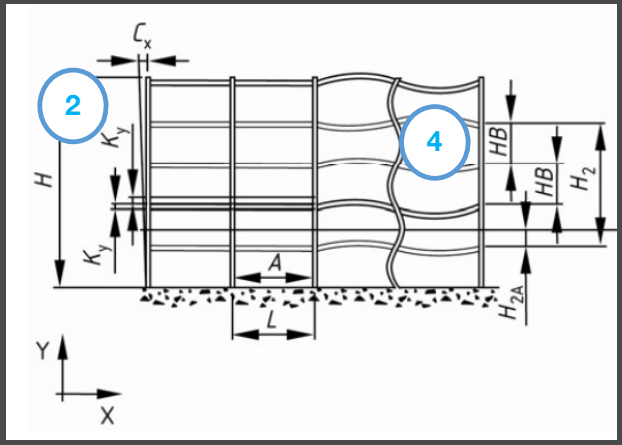
One Rack Assembled,Floor level aligned to meet the Plumb and inspected for parameters as defined in EN 15620 racking class 100.

Elevation Drawing



Pre Mock up results after Assembly in Existing Condition





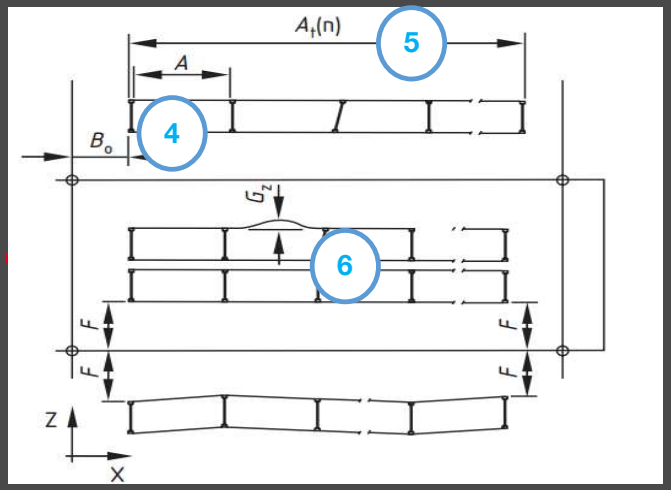
Sl no	Description	Spec in mm And Tolerance as per EN15620 Class 100	Actual observations in mm	Result
1	Out of Plumb in Y direction (Cy)	+/-15	-5, +5, -4, +4, -1	Ok
2	Out of Plumb in X direction (Cx)	+/-15	+ 8 , -10	Ok
3	Frame Width	1200+/- 3mm	1203 to 1204	Not Ok
4	Distance between 2 Adjacent beams (HB)	1800+/- 3mm	1801 to 1802	OK

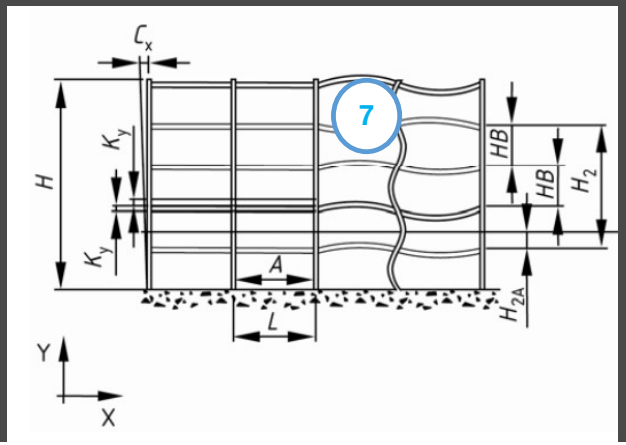
Key Observations:

After Assembly,rack at Lifted condition, Water Level checked and all the Uprights adjusted by providing Shim under the foot plate to match the same floor level. Plumb (Cz) checked in Ydirection and observed (in mm) -66 ,+23 ,-12 , -14, 11.

Plumb corrected by removing and adding shim under the foot plate, Final Plumb observed (in mm) -5 ,+5, -4, + 4, -1

Pre Mock up results after Assembly in Existing Condition





Sl no	Description	Spec in mm And Tolerance as per EN15620 Class 100	Actual observations in mm	Result
4	Clear Entry Width Between Uprights (A)	2700+/-3	2700 to 2703mm	Ok
5	Total rack Length (At)	11250+/-20	11259/11260	Ok
6	Straightness of the beam in Z direction (Gz)	+/-6.75	1 mm	ok
7	Straightness of the beam in Y direction	+/-6.75	Up to 2.5mm	OK

- Diagonal distance between Uprights checked and adjusted to meet within 5mm.

Next Progress

- **Upright to be Roll formed once after reciept of correct Raw material having yield strength more than 275 N/Sq mm.**
- **Assembly and Installation to be carried out with Skilled Installation team after Floor marking and levelling.**


THANK YOU
FOR YOUR ATTENTION