SPECIFICATION No.: CLW/ES/03/053

ALT.	20														
Sheet															

Total Number of Sheets: 16

SPECIFICATION

for

STAINLESS STEEL PIPE FITTINGS OF PNEUMATIC SYSTEM FOR 3 PHASE ELECTRIC LOCOMOTIVE

ISSUED BY:

ELECTRIC LOCO DESIGN OFFICE
CHITTARANJAN LOCOMOTIVE WORKS
P.O. CHITTARANJAN – 713331, DIST. BURDWAN,
WEST BENGAL (INDIA)

<table>
<tr><td rowspan="3">SPECIFICATION FOR STAINLESS STEEL PIPE FITTINGS OF PNEUMATIC SYSTEM FOR 3 PHASE ELECTRIC LOCOMOTIVE</td><td>Prepared By

SSE/D</td><td>Reviewed By

SEE/D/CON</td><td colspan="7">ELECTRIC LOCO DESIGN OFFICE
CHITTARANJAN LOCOMOTIVE WORKS/CHITTARANJAN(W.B.)

Specn No. CLW/ES/03/053 ALT-20</td></tr>
<tr><td colspan="2">Approved By

Dy.CEE/D-I</td><td rowspan="2">ALT</td><td>20</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

ALTERATION SHEET

SN	Date	Clause No.	Page No.	Description	Alt	Approved By
1.	24.08.98			ITEMS AT SL. NOS. 64,65, NOTE-1 IN ANNEXURE-A (SHEET NO.7) 7 ALTERATION SHEET NO.1 (SHEET NO. 8) ADDED. ITEM AT SL. NO. 2, 53 DELETED.	1	
2.	24.08.99			QTY. OF EQUAL TEE Ø22 AT SL NO. 8 WAS 2/LOCO SET. QTY. OF REDUCING UNION TEE Ø22/Ø22/ Ø15 AT SL. NO. 13 WAS 04/LOCO SET	2	
3.	06.03.2000			ITEM AT SL NO. 66 ADDED QTY.OF ITEM AT SL NO. 26 WAS 6/LOCO SET. QTY OF ITEM AT SL NO3 WAS 6/LOCO SET. ITEM AT SL. NO. 59 DELETED.	3	
4.	08.10.01			THE ENTIRE SPECIFICATION EXCEPT ALT. SHEET HAS BEEN REVISED & UPDATED, SUPERSEDING SPECN NO. CLW/MS/3/053 ALT.3	4	
5.	19.03.02			ITEM SL NO.51ADDED DRG SL NO OF ITEMS FROM SL NO 21 TO 28 RECTIFIED.	5	
6.	26.04.02			SHEETS 8 & 9 DELETED & DETACHED FROM AND SHEETS 8A & 9A (REVISED ANNEXURE-I) INCLUDED IN THE SPECIFICATION. BASED ON JOINT NOTE MADE BY SHOP-16 & C-D&D ON 18.04.02 & COUNTERSIGNED BY WM/ELA-I & AME/D&D-II	6	
7.	15.11.02			ITEMS AT SL NOS. 3,8,9 & 46 DELETED QUANTITIES OF ITEMS AT SL . NOS. 1,4,6 & 10 WERE 14,20,14 & 26 RESPECTIVELY. BASED ON JOINT NOTE MADE BY SHOP-16 & C C&D ON 31.09.02 7& COUNTER SIGNED BY AME/D&D –II. THIS IS DUE TO	7	

				DELETION OF WHEEL FLANGE LUBRICATION SYSTEM ON LOCO.		
8.	19.12.02			ITEMS AT SL. NOS. 16 DELETED QTY. OF ITEMS AT SL. NO. 46 RE-INSISTED. BASED ON JOINT NOTE MADE BY SHOP-16 & C-D&D 0N AND COUNTERSIGNED BY AME /D&D-I	8	
9.	01.10.13			"i.e. between 85HRB to 90 HRB" ADDED TO THE LAST SENTENCE UNDER CLAUSE 5.2 DRG. NO. AGAINST ITEM SL. NO. 47 WAS 1209-18.406-026. TO SPECIFY FERRULE HARDNESS ITEM DRG. NO. CORRECTED.	9	DY.CEE/ELA
10.	13.07.04			ITEM SL NO. 49, 50 ADDED ITEM NO. 49 RE ITEM NO 50 ADDED IN LIEU OF ¾" BRASS SOCKET AS PER WM/ELA'S LETTER NO. DCME/ELA/43/3Ø DATED 12.11.13	10	DY.CEE/D
11.	05.05.05			ITEM SL. NO. 51 ADDED QTY. OF ITEM AT SL. NOS. 33,34,36 WERE 5,10,5. DUE TO MODIFIED PIPE LAYOUT FOR ANTI SPIN VALVE VIDE RDSO'S LETTER NO. EL/3.1.35/2 DT. 28.01.03	11	
12.	21.08.06			NOTE 1 ADDED IN SHEET 9A AS PER SHOP'S REQUIREMENT	12	
13.	28.11.09			QTY OF ITEM SL. NO. 23 WAS 11 & SL NO.43 DELETED DUE TO ABOLISHION OF K PORT LINE FROM U/F.	13	DY.CEE/D
14.	20.10.10			QTY./LOCO CLOUMN DELETED FROM SPECN. WAG-9 CHANGED AS WAG-9H AND WAP-7 ADDED. TO AVOID CONFLICT IN CAT BOOK & SPECN.	14	DY.CEE/D
15.	04.04.11			ITEM SL NO 52 NEWLY ADDED ONLY FOR WAP-7 DUE TO NEW PIPE LAYOUT FOR AIR DRYER FOR WAP-7.	15	DY.CEE/D
16.	16.11.11			ANNEXURE 'A' (PAGE NO 8A & 9A) DELETED TO AVOID THE MISMATCH BETWEEN CAT BOOK & SPECIFICATION.	16	DY.CEE/D
17.	14.02.12			SHEET 8A SL. NO. 18.19.26 AND SHEET	17	DY.CEE/D

				NO 9A SL NO. 31& 35 SIZE 10 WAS 3/8" O/D SHEET NO 3 GRADE- 1018 ADDED.		
18.	17.01.14			SHEET 9B ADDED AND DRG NO 1209-18.406-036, 1209-18.406-026, 029 REVISED/UPDATED.	18	DY.CEE/PROJ/CON
19.	26.03.15			ITEM SL. NO. 61 ADDED IN SHEET NO. 9B. APPROVED BY CEE/LOCO ON NOTE NO. ELDD/3606 DT. 10.03.2015	19	DY.CEE/D-I

Table of Contents

1. SCOPE

This specification prescribes the requirements for stainless steel pipe fittings with S.S. Double Ferrule Fittings for compressed air transmission for braking purpose in three-phase electric locomotives (WAG9/WAG9H, WAP7 and WAP5). Operating air pressure may be as high as 11.5 kg/cm^2. Normal air pressure is 10 Kg/Cm^2.

2. SCOPE OF SUPPLY

One set of S.S. Pipe fittings shall consist of all items indicated in Annexure - I of specification in quantity equal to quantity per loco of individual items mentioned therein.

3. CLIMATIC AND ENVIRONMENTAL CONDITIONS

a) Maximum Atmospheric Temperature:

Under Sun : 75^0 C
In Shed : 55^0 C

b) Humidity:

100% saturation during rainy season.

c) Reference site condition:

Ambient Temp : 47^{0}C (Max) & -5^{0}C (Min)
Humidity : 60%
Altitude : 160 m above sea level

d) Rainfall:

Very heavy in certain areas. The locomotive will be designed to permit its running at 10 Km/Hr. in flood water level of 102 mm above rail level.

e) Atmosphere during hot weather:

Extremely dusty and desert terrain in certain areas.

f) Coastal areas:

Locomotives and equipment shall be designed to work in coastal areas in humid and salt laden atmosphere.

g) Vibration:

The equipment, sub system and their mounting arrangement will be designed to withstand vibration and shocks encountered in service as specified in corresponding IEC publication unless otherwise prescribed.

4. STANDARDS:

4.1. Latest version of specification shall be applicable unless otherwise specified.

4.2. Material and Dimensional Standards referenced

i. ASTM A108 Gr.1018
ii. ASTM A276 SS 316
iii. ASTM A269 SS 316
iv. ASTM A105/
v. ISO 7/1
vi. ISO 228/1
vii. CLW Spec MS/3/029

4.3. Certification/Performance Standards referenced

i. ISO 9001:2015 (or latest version)
ii. ASTM F1387-99 (2012)
iii. ASTM A262
iv. IS 9844
v. IEC 60068-2-52
vi. IEC 61373

5. GENERAL & TECHNICAL DATA:

5.1. The fittings are to be used/swaged with annealed, high quality seamless austenitic stainless steel (Gr. TP 304) tubing conforming to ASTM A269 of hardness as per CLW Spec MS/3/029 Clause 5.9

5.2. All straight pipe fitting bodies shall be made from carbon steel conforming to ASTM A108 Gr. 1018.

5.3. Angle fittings will be manufactured from forged blocks conforming to ASTM A105 and there will be no step and pit marks on the forged body.

5.4. Fittings shall not have sharp edges and all parts of the fittings shall be cleaned to get rid of burrs, dirt, grease, etc. and to get a clean matt finish.

5.5. Ferrules are from stainless steel (Gr.316) conforming to ASTM A276 bar stock. The hardness of the ferrules must be greater than that of the tubing by 5-10 HRB.

5.6. The back ferrule shall be case hardened to a case depth of 27 microns (min) through a suitable case hardening process to achieve a minimum hardness of 1000 VPN HV

(0.05). The back ferrule shall successfully complete the Intra-Granular Corrosion test and 96 hours of corrosion performance as per clause 7.2 (l) and (k) respectively.

5.7. Each fitting shall be re-usable after dismantling & assembling for at least 25 times.

5.8. The fittings shall be able to produce a leak proof joint in either Pressure or vacuum service.

5.9. The size by which the fittings are designed shall be the outer diameter of the fittings with which they are to be used.

6. DESIGN PRINCIPLE/MANUFACTURING:

6.1. All pipe fittings shall confirm to accompanying drawing.

6.2. Pipe fittings shall have a safe and reliable, torque free, leak proof performance at all tubing connections.

6.3. All the tube fittings when swaged with recommended tubing (ref Clause 5.1) must be capable of withstanding the following types of forces:

a) Internal Pressure
b) Tension or axial pull
c) Compression of axial push
d) Torque of Twist
e) Vibration
f) Temperature Variation
g) Any combination of these forces

6.4. Construction of the fittings must have the following features:

a) Self-aligning
b) Work on thick or thin wall tubing
c) No weakening of tube wall
d) No locking of ferrule in nuts before and after swaging.
e) No Axial movement of ferrule after swaging
f) No Radial movement of back ferrule
g) Should not create torque or leave residual strain on tubing
h) Should have residual spring condition so that temperature cycling will not cause any leakage
i) Should not significantly reduce flow area
j) Should have enough tube support ahead of the seal to resist any vibration

k) Can contain any pressure up to the burst point of the tubing without leakage
l) Seal repeatedly under make-and-break conditions.
m) One (1) micron finish on sealing surface and three (3) micron finish overall without any annular tool marking.
n) The design of the fittings should be such that they need not require dis-assembly before assembly with tubing and should not require any special tools.

NB: Bidder shall indicate any deviations from design principle /manufacturing or any kind of technical deviation including scope of supply as indicated in the specification.

7. INSPECTION AND ACCEPTANCE:

7.1. **General**: The manufacturer shall submit one prototype sample set (consisting of all items quantity wise as indicated in Annexure-I) for the purpose of inspection and conducting type testing at their works premises. These are to be witnessed by an authorized representative of the Purchaser and the cost of the same will be borne by manufacturer/bidder.

7.2. The test specimens being offered for prototype inspection shall have capability of withstanding the following tests:

a) Visual/Dimensional checks:

Fittings will be checked for overall finish, workmanship and dimensions; Dimensional checking will be carried out by properly calibrated measuring/checking instruments.

b) Inspection before/during/after test:

After assembly of tube fittings along with tube it forms a test specimen. After each dis-assembly of the test specimen, assembly coupling, the component and the tubing shall be examined for:

i. Damage of ‘o’ ring if any
ii. Formation of fatigue crack at thread roots
iii. Damage of ferrule
iv. Damage of sealing face.
v. Damage or cracking of tube.

Following measurements are also to be recorded after each dis-assembly:

i. Inside bore diameter of body, front ferrule, back ferrule and nut.
ii. Skirt diameter of body.
iii. Outside diameter of front ferrule and back ferrule

iv. Length of front ferrule, back ferrule and nut.

c) Pneumatic Proof Test:

Test assembly consisting of male connector, union, union tee, elbow & cap to 6 to 8 inch tube length for each size of fitting in Annexure I. Tube as per CLW Spec MS/3/029 of desirable OD (total 4 assemblies) tightened 1-1/4 turn past snug. Pressurize each test assembly initially to 7 kg/ cm^2 and hold for 5 minutes. Observe any leakage. Then gradually increase the pressure to 40 Kg/cm^2 (Pneumatic Pressure). Hold at that pressure for 10 minutes. If no leak is found, the fittings are to be disassembled and shall be inspected as per Clause 7.2(b).

d) Hydrostatic Proof Test:

After the completion of Pneumatic re-assemble the test specimen as stated in 7.2 (c) and pressurize each test assembly for hydro test initially to 7 kg/ cm^2 for 5 minutes. If no leakage is observed, increase the pressure to 200 Kg/cm^2 and hold at that pressure for 15 minutes. If no leak is found, the fittings are to be disassembled and shall be inspected as per Clause 7.2(b).

e) Vibration and Shock Test

i. After completion of Hydrostatic Proof Test, re-assemble the fitting as per Clause 7.2(c).
ii. Vibration and Shock test to be conducted as per IEC -61373 standard.
iii. On completion of test, the assembly must successfully pass the Hydrostatic Proof Test as per clause 7.2(d).
iv. On completion of test, dis-assembly the assembly and the fittings are to be inspected as per Clause 7.2(b).

f) Pressure Impulse cum Vibration Test

After the completion of Hydrostatic Proof Test, re-assemble the fittings as stated in 7.2(c) and test to be carried out as follows:

i. Each test assembly shall be subjected to vibration frequency of 60 Hz, with amplitude of 5 mm, simultaneously pressure cycling up to 100 kg/cm2 at 35+5 impulse/minute with suitable hydraulic fluid.
ii. Pressure impulse shall be run for 500000 cycles (minimum) and vibration for minimum of 10 X 10^6 cycles.
iii. Assembly is monitored for leakage during the test.
iv. On completion of test, the assembly must successfully pass the Hydrostatic Proof Test as per clause 7.2(d).
v. On completion of test, dis-assembly the assembly and the fittings are to be inspected as per Clause 7.2(b).

g) Vacuum Test:

i. After completion of Pressure Impulse cum Vibration Test, re-assemble the fittings as stated in 7.2(c).

ii. Vacuum test shall be conducted at 750 milli bars with a test volume of 1 liter of water capacity. The deterioration of vacuum shall not exceed 20 milli bars over a period of 20 minutes.

iii. On completion of test, dis-assembly the assembly and the fittings are to be inspected as per Clause 7.2(b).

h) Make & Break Hydrostatic Test:

After the completion of Vacuum test re-assembly the fittings as per Clause 7.2(c) and then:

i. Assembled torque to be recorded

ii. Dis –assemble & reassemble to the original torque

iii. Repeat the make & break for 6 times.

iv. After 6^{th} assembly pressurize the assembly with suitable hydraulic media to 100 kg/cm2 with suitable S.S. tubing as per as per CLW Spec MS/3/029 and hold the pressure for 5 minutes and observe the leak.

v. If no leakage is found, release the pressure and continue the make & break procedure for 25 times.

vi. After the end of 25 cycles, pressurize the test assembly to 200 kg/cm^2 and hold the pressure for 15 minutes.

vii. Components are to be randomly interchanged after each dis-assembly during the test to simulate field conditions.

viii. If no leakage is found dis-assemble the test assembly and fitting shall be inspected as per Clause 7.2(b). Any specimen exhibiting damage or leakage (other than tube bursting) shall be considered as failure.

i) Temperature Cycling Test:

i. After completion of Make & Break Test, re-assemble the fitting as per Clause 7.2(c).

ii. Then each test assembly shall be subjected to 3 temperature cycles each of approximately 3 hours duration.

iii. In temperature cycle, temperature should increase to 100^o C in 45 +15 minutes and held for 60 minutes .Then the temperature should reduce to ambient form 100^0 C in 45+15 minutes.

iv. On completion of test, the assembly must successfully pass the Hydrostatic Proof Test as per clause 7.2(d).

v. On completion of successful temperature cycling test disassemble & re-assemble the fittings and the fitting shall be inspected as per Clause 7.2(b).

j) Tensile Test:

i. After completion of Temperature Cycle Test, re-assemble the fitting as per Clause 7.2(c).
ii. Tensile test to be conducted as per ASTM F1387-99 standard.

k) Hydrostatic Burst Test:

i. Assembly that has successfully completed Temperature Cycle Test, is re-assembled as per Clause 7.2(c).
ii. Hydrostatic burst test to be conducted as per ASTM F1387-99 standard.

l) Salt Mist Test:

i. This test to be conducted only on the back ferrule.
ii. Each size of back ferrule to be randomly selected for salt spray test as per IEC 60068-2-52 standard for 96 hrs.
iii. The ferrule shall not have any corrosion up to 96 hours.

m) Neutral Salt Spray Test:

i. This test to be conducted only on the back ferrule.
ii. Each size of back ferrule to be randomly selected for salt spray test as per IS 9844 standard for 96 hrs.
iii. The ferrule shall not have any corrosion up to 96 hours.

Note: *Vendor may give their suggestion for inclusion of either Salt Mist Test or Salt Spray Test.*

n) Intra-Granular Corrosion Test:

i. This test to be conducted only on the back ferrule.
ii. Each size of back ferrule to be randomly selected from the offered material for Intra-Granular Corrosion Test as per ASTM A262 Practice-E.
iii. On completion of test, the ferrule shall not show any Intra-Granular Corrosion.

o) Interchangeability/Intermixability Test:

Manufacturer/bidder must certify that components of fitting are interchangeable with other CLW approved sources of the same item.

7.3. Manufacturer/bidder must have in-house test facilities for carrying out the tests indicated Clause 7.2 (a), (b), (c), (d), (f), (g), (i), (j) and (m). For remaining tests, the manufacturer/bidder may submit relevant test certificates from Government approved test laboratory, at the time of inspection. Expenditures towards these will be borne by the manufacturer/bidder.

7.4. ROUTINE TEST /INSPECTION:

a) Routine test will be carried out by authorized representative of the purchaser as per approved routine test program submitted by the manufacturer. Tests mentioned at Clause 7.2 (a), (b), (c), (d), (f) & (g) are compulsory for routine test, whereas rest of the tests are at discretion of the purchaser.

b) The tenderer shall indicate the sample size including minimum size for routine inspection pf each lot and the acceptance criteria for acceptance by the purchaser.

7.5. Type test shall be repeated in following cases:

(i) First time supply to IR
(ii) Failure or variations established during type or routine test
(iii) Consistency type test within 5 years of the last type test to reestablish performance parameters

7.6. Railway reserves the right to perform any of above tests at any time to establish specific performance parameter.

8. SUPPLY OF DOCUMENTATION:

8.1. Along with tender offer –

a) The tenderer shall submit dimensioned manufacturing drawing indicating manufacturing tolerances, part drawings of individual items and sub-assemblies, part listing of Assly./Sub. Assly, Material Specification. Technical Data /calculation in duplicate for purchasers examination/checking, scrutiny and authentication.
b) Any deviation from Specified values shall be spelled out clearly by the tenderer.
c) The Tenderer shall submit all in-house facilities available for both type test and routine test. They should also clearly mention the tests to be carried out at Rly/RDSO approved test house.
d) The tenderer shall submit proof of supply of double ferrule compression type fittings for three years to Indian or Global railways.

8.2. Along with supply, successful tenderers shall submit along with supply the required copies of list of items supplied, certified copies of material and test certificates from Government approved test laboratory and guarantee certificate for the supplied items.

9. QUALITY ASSURANCE:

System Certification: Firm to have obtained system certification against ISO 9001:2015 (or latest version)

10. MARKING:

Each assembly, sub-assembly/component shall have clear readable laser etched/engraved marking, particularly body and back nuts. Marking shall be as follows:

a. Manufacturer's name/trade mark
b. Part no. and size (in mm/inch)
c. Traceability of raw material

NB: Both front ferrule and back ferrule of size 1" & above shall have manufacturers name/trade mark engraved/punched on them at suitable location.

11. GUARANTEE:

11.1. The equipment and its accessories shall be guaranteed for satisfactory performance for a period of 24 months from the date of delivery or 18 months from date of commissioning of the locomotives, whichever is earlier. All aspect of workmanship and material will be covered by the guarantee.

11.2. The components /material which fail during the guarantee period must be replaced by the manufacturer /contractor for free of cost.

12. PACKING:

All pipe fittings shall be properly packed to avoid damage during transit and storage.

ANNEXURE-I

SN	DRAWING NO.	ALT. NO.	DESCRIPTION	REMARKS
1	1209-18.406-010 SL.-1	2	MALE ELBOW 10MM TUBE X 3/8" ISO TAPER	
2	1209-18.406-012 SL.-1	4	STRAIGHT COUPLING Ø10 TUBE(TYPE P-GV)	
3	1209-18.406-013 SL.-2	4	BULKHEAD COUPLING Ø10 TUBE	
4	1209-18.406-013 SL.-3	4	BULKHEAD COUPLING Ø15 TUBE	
5	1209-18.406-014 SL.-1	4	EQUAL TEE Ø10 (TYPE P-TV)	
6	1209-18.406-014 SL.-3	4	EQUAL TEE Ø22 (TYPE P-TV)	
7	1209-18.406-016 SL.-2	4	EQUAL ELBOW Ø10(TYPE P-WV)	
8	1209-18.406-016 SL.-4	4	EQUAL ELBOW Ø22(TYPE P-WV)	
9	1209-18.406-020 SL.-1	2	REDUCING UNION TEE Ø22/15/22	
11	1209-18.406-020 SL.-2	2	REDUCING UNION TEE Ø22/15/15	
12	1209-18.406-020 SL.-3	2	REDUCING UNION TEE Ø22/22/15	
13	1209-18.406-022 SL.-1	2	REDUCER FITTING 1" TUBE X 1 ½" PIPE	
14	1209-18.306-024 SL.-1	2	1"TUBE X 1" FEMALE ELBOW SPL	
15	1209-18.406-036 SL.-2	5	10 mm TUBE X 3/8" BSPT MALE ELBOW	
16	1209-18.406-036 SL.-8	5	10 mm TUBE X 1/2" BSPT MALE ELBOW	
17	1209-18.406-036 SL.-12	5	½" TUBE X 3/8" BSPT MALE ELBOW	
18	1209-18.406-036 SL.-3	4	½" TUBE X 1/2" BSPT MALE ELBOW	
19	1209-18.406-036 SL.-7	4	1" TUBE X 3/4" BSPT MALE ELBOW	
20	1209-18.406-036 SL.-4	4	1" TUBE X 1" BSPT MALE ELBOW	
21	1209-18.406-036 SL.-5	4	1 1/2" TUBE X 1 1/4" BSPT MALE ELBOW	
22	1209-18.406-036 SL-6	4	1 1/2"X1 1/2" BSPT MALE ELBOW	
23	1209-18.306-026 SL-3	3	MALE CONNECTOR 10MM TUBE X ¼" ISO TAPER	
24	1209-18.306-026 SL-2	3	½" TUBE X ½" BSPT MALE CONNECTOR	
25	1209-18.306-026 SL-3	3	1" TUBE X 1" BSPT MALE CONNECTOR	
26	1209-18.306-026 SL-5	3	11/2"TUBEX11/4"BSPT MALE CONNECTOR	
27	1209-18.306-027 SL-1	3	ELBOW UNION 1" SPL	
28	1209-18.306-028 SL-1	3	UNION 10 SPL	
29	1209-18.306-028 SL-2	3	UNION ½" SPL	
30	1209-18.306-028 SL-3	3	UNION 1" SPL	

SPECIFICATION FOR STAINLESS STEEL PIPE FITTINGS OF PNEUMATIC SYSTEM FOR 3 PHASE ELECTRIC LOCOMOTIVE	Prepared By SSE/D	Reviewed By SEE/D/CON	ELECTRIC LOCO DESIGN OFFICE CHITTARANJAN LOCOMOTIVE WORKS/CHITTARANJAN(W.B.) Specn No. CLW/ES/03/053 ALT-20					
	Approved By Dy.CEE/D-I		ALT	20				

31	1209-18.306-028 SL-4	3	UNION 1 ½" SPL	
32	1209-18.306-029 SL-1	3	UNION TEE 10	
33	1209-18.306-029 SL-2	3	UNION TEE 1"	
33	1209-18.306-029 SL-3	3	UNION TEE 1 1/2"	
34	1209-18.306-031 SL-1	3	UNION TEE SPECIAL1 1/2"	
35	1209-18.306-031 SL-2	3	UNION TEE SPECIAL1 1/2"	
36	1209-18.306-031 SL-3	3	UNION TEE SPECIAL1 1/2"	
37	1209-18.306-031 SL-4	3	UNION TEE SPECIAL1 1/2"	
38	1209-18.306-031 SL-5	3	UNION TEE SPECIAL 1"	
39	1209-18.406-035 SL-1	2	MALE ELBOW ⌀ 10 MM TUBE X ¼" NPT	
40	1209-18.406-036 SL-11	4	MALE ELBOW ⌀22MM TUBE X ¾ ' ISO TAPER	
41	1209-18.406-039 SL-1	3	MALE CONNECTOR ⌀10 MM TUBE X ¼" ISO TAPER	
42	1209-18.306-026 SL-4	3	MALE CONNECTOR 1" TUBE X 1" ISO TAPER	
43	1209-18.406-037 SL-1	1	THREADED TEE 1 ¼" FTT	
44	1209-18.406-037 SL-2	1	BSP THREADED TEE 1 1/2"(F) X 1 1/2"(F) X 1 1/2"(F)	
45	1209-18.406-176 SL-2	-	¾" BSPP X BSPP THD. REDUCING BUSH (M/F)	
46	1209-18.406-218 SL-1	-	REDUCING UNION TEE 1 ½" X 1 X 11/2"	
47	1209-18.406-167 Ref.1	1	UNION ELBOW 1 1/2" TUBE X 1 ½" TUBE	ONLY FOR WAP-7
48	1209-18.406-036 Ref.13	6	MALE ELBOW 10 OD TUBE ¼"BSPT	
49	1209-18.406-036 Ref.14	6	MALE ELBOW ½" TUBE ¼"BSPT	
50	1209-18.406-036 Ref.15	6	MALE ELBOW ½" TUBE ½"BSPT	
51	1209-18.306-026 Ref.8	6	MALE CONNECTOR 1 ½" TUBE X 1 ½"	
52	1209-18.306-026 Ref.4	6	UNION TEE ½" TUBE X ½" TUBE X ½" TUBE	
53	1209-18.306-029 Ref.5	6	UNION TEE 1" TUBE X ½" TUBE X 1" TUBE	
54	1209-18.406-036 Ref.16	6	MALE ELBOW ¼" TUBE ¼"BSPT	
55	1209-18.406-220 SL.NO-2	NIL	REDUCER (ADAPTER)	

Note: As per Shop's requirement 38.1Φ – 4 nos., 25.4Φ – 3 nos., 22Φ – 2 nos. extra ferrules are to be supplied along with the set of SS-Pipe Fittings.

SPECIFICATION FOR STAINLESS STEEL PIPE FITTINGS OF PNEUMATIC SYSTEM FOR 3 PHASE ELECTRIC LOCOMOTIVE	Prepared By SSE/D	Reviewed By SEE/D/CON	ELECTRIC LOCO DESIGN OFFICE CHITTARANJAN LOCOMOTIVE WORKS/CHITTARANJAN(W.B.) Specn No. CLW/ES/03/053 ALT-20					
	Approved By Dy.CEE/D-I		ALT	20				