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Ministry of Defence (DGQA)
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Dte of Quality Assurance (WP)
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'H' Block, Nirman Bhawan P.O.,
नई दिल्ली/New Delhi – 110011

No. 12286/SQAP/Metallic Expansion Joints/DGQA/WP-III

27 Nov 19

The Principal Director
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New Delhi – 110011

The Principal Director
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The Principal Director
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IHQMOD(N)
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The Controller of Procurement
Material Organisation
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The Material Superintendent
(for Controller of Procurement)
Material Organisation
Kancharpalem Post
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The Material Superintendent
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The Material Superintendent
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The Chief Quality Assurance Officer
Chief Quality Assurance Establishment (WE)
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Vikhroli (W), Mumbai – 400083

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Dockyard Road, Mazgaon
Mumbai-400010

M/s GRSE
(For Chief General Manager (Material))
43/46 Garden Reach Road
Kolkata-700024

M/s Cochin Shipyard, Ltd
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Cochin-682015

The Chief Quality Assurance Officer
Chief Quality Assurance Establishment (MS)
7th Floor, NMRL Complex
Tiger Gate, Naval Dockyard
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The Quality Assurance Officer
Quality Assurance Establishment(WE)
DGQA Complex
Palvanthangal, Chennai - 600114

The Quality Assurance Officer
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Vadodara – 390008

The Quality Assurance Establishment
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Commissariat Road, Hastings
Kolkata - 700022

M/s Fluidyne Engineers(P) Ltd
392/1B, Velachery, Tambaram Main Road
Medavakkam, Chennai - 601302

M/s Flexicon Bellows & Hoses (P) Ltd
283, GIDC Estate, Makarpura
Vadodara - 390010

M/s Siala Industrial Works
31, Chanditata Main road
Kolkata - 700041

M/s Lonestar Industries
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Thiruvanmiyur, Chennai - 600041

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M/s Metallic Bellows
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Chennai-600041

M/s Flexatherm Expanllow Pvt Ltd
354, GIDC
Makarpura, Vadodara - 390010

M/s Titanium Tantalum Products Limited
86/1, Vengaivasal Main Road,
Govrivakkam, Chennai – 601302

M/s Accuferrous Survey
No 12, Hissa No 3A-4/1, Lagad Mala Vadgaon
Khurd Singhad, Pune - 411041

01

FORWARDING OF APPROVED STANDARD QUALITY ASSURANCE PLAN (SQAP)
FOR METALLIC EXPANSION JOINTS/ BELLows

1. Refer this office letter of even no dated 10 May, 23 Oct and 05 Nov 19.
2. DQA(WP) approved SQAP DGQA/DQA(WP)/Metallic Expansion Joints/20/2019 Rev 0 dated 19 Nov 19 is forwarded herewith for reference and records.
3. It is requested that the SQAP be further promulgated to all concerned, not addressed in this letter.
4. The SQAP can also be accessed from DGQA website www.dgqadefence.gov.in [Home Page → Technical Directorates → DQA(WP)].



(Rajiv Sharma)
Captain (IN)
Capt QA(GP-III)
for ADGQA(WP)

Encl: As above



MINISTRY OF DEFENCE (DGQA)

STANDARD QUALITY ASSURANCE PLAN FOR METALLIC EXPANSION JOINTS

STANDARD QAP NO. DGQA/DQA (WP)/Metallic Expansion Joints/20/2019 REV 0

Total Nos. of Pages: 17
ISSUING AUTHORITY

DIRECTORATE OF QUALITY ASSURANCE (WARSHIP PROJECT)
MINISTRY OF DEFENCE (DGQA)
'H' BLOCK, NIRMAN BHAWAN PO
NEW DELHI - 110 011





	MINISTRY OF DEFENCE (DGQA)	METALLIC EXPANSION JOINTS	PAGE	02
	DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/METALLIC EXPANSION JOINTS/20/2019/REV 0	REV NO	00

RECORD OF AMENDMENTS

	MINISTRY OF DEFENCE (DGQA)	METALLIC EXPANSION JOINTS	PAGE	03
	DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/METALLIC EXPANSION JOINTS/20/2019/REV 0	REV NO	00
			DATE	19 Nov 19

MINISTRY OF DEFENCE (DGQA)

STANDARD QUALITY ASSURANCE PLAN FOR METALLIC EXPANSION JOINTS



STANDARD QAP NO.
DGQA/DQA(WP)/ METALLIC EXPANSION JOINTS
/20/2019/REV 0 DATED 19 Nov 2019

(A. George
Rear Admiral
ADGQA (WP))

Promulgated by:-

DIRECTORATE OF QUALITY ASSURANCE (WARSHIP PROJECT)
MINISTRY OF DEFENCE (DGQA)
'H' BLOCK, NIRMAN BHAWAN PO
NEW DELHI - 110 011

	MINISTRY OF DEFENCE (DGQA)	METALLIC EXPANSION JOINTS	PAGE	04
	DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/METALLIC EXPANSION JOINTS/20/2019/REV 0	REV NO	00
			DATE	19 Nov 19

CONDITION OF RELEASE

1. This standard QAP has been prepared for use of the Indian Navy and of its contractors to follow the specified Quality Assurance procedure during the execution of the contracts. No alteration is to be made to this Standard QAP except by the issue of authorised amendment by DQA (WP).
2. It is to be applied as required in the Quality Assurance procedures covering manufacture of Metallic Expansion Joints for IN Ships.
3. The website <http://www.dgqa defence.gov.in> may also be referred for other QA requirements.
4. The Standard QAP has been prepared on the basis of decisions made in consultations with leading manufacturers of Expansion joints, representatives of professional directorates and inspection agencies. Any user of this Standard QAP either within DGQA / Indian Navy or in industry may propose an amendment to it with valid justification. Proposals not applicable to particular contract can be sent directly to DQA (WP), New Delhi, and those directly applicable to a particular contract are to be dealt with using contract procedures.
5. DQA (WP) reserves the right to amend or modify the contents of this Standard QAP without consulting or informing any holder of this document.
6. When this Standard QAP is incorporated into contracts, users are responsible for their correct application and for complying with contractual and other statutory requirements. Compliance with Standard QAP does not of itself confer immunity from legal obligations.
7. Enquiries in connection to these requirements may be made from:

DIRECTORATE OF QUALITY ASSURANCE (WARSHIP PROJECT)
 MINISTRY OF DEFENCE (DGQA)
 'H' BLOCK, NIRMAN BHAWAN PO
 NEW DELHI - 110 011



MINISTRY OF DEFENCE (DGQA)

DIRECTORATE OF QUALITY
ASSURANCE (WP)
NEW DELHI - 110 011

METALLIC EXPANSION JOINTS

PAGE

05

STANDARD QAP NO.
DGQA/DQA(WP)/METALLIC
EXPANSION
JOINTS/20/2019/REV 0

REV NO

00

DATE

19 Nov 19

CONTENTS

<u>S.No.</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
1.	Guiding Standards/ Specifications/ Refernces	06
2.	Specific Requirements	08
3.	Abbreviations	00
4.	Scope	10
5.	System Description	11
6.	Part-I: General Information	12
7.	Part-II : Technical Inspection/Trials	13
APP 'A'	Standard QAP Metallic Expansion Joints	14-17

	MINISTRY OF DEFENCE (DGQA)	METALLIC EXPANSION JOINTS	PAGE	06
	DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/METALLIC EXPANSION JOINTS/20/2019/REV 0	REV NO	00
			DATE	19 Nov 19

GUIDING STANDARDS / SPECIFICATIONS/ REFERENCES

APPLICABLE SPECIFICATIONS

The general specifications pertaining to a typical bellow manufacture, tests, trials, QA and installation are as follows:

SI No	Standard	Description of standard
1	EJMA	Expansion Joints Manufacturer's Association Standard for Design of Bellows.
2	ASTM 2934-12	Standard specification for circular metallic bellow type expansion joint for HVAC piping application
3	ASTM F 1120	Standard specification for circular metallic bellow type expansion joint for piping application
4	ASME BPV section IX	Welding and Brazing qualifications
5	ASME SEC VIII	Pressure Vessels
6	ANSI B16.5	Pipe Flanges and Flanged Fittings
7	NES 772 (DG)	General welding specification for machinery Ships/PS/9023purposes
8	IS 919 Part I and II	ISO Systems of limits and fits.
9	GOST 2.61 – 95	Documentation.
10	NES 1004	Requirements for the design and testing of equipment to meet environmental conditions
11	BR 3021	Requirements for high impact (IN shock grade 'A' Tests for Shipyard machinery equipment and shock grade curves)
12	NES 360	Valves
13	NES 320	Design & Installation requirements of fuel system
14	DME 452	Documentation specifications
15	DME 457	Guidelines for allowances of spares
16	IS 2062	Specification for Structure Steel
17	NES 723	Tally Diagram Plates
Environmental Condition		
18	NES 1004	Requirement for the design & testing of equipment to meet environmental condition

	MINISTRY OF DEFENCE (DGQA)	METALLIC EXPANSION JOINTS	PAGE	07
	DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/METALLIC EXPANSION JOINTS/20/2019/REV 0	REV NO	00
			DATE	19 Nov 19

Shock, Noise and Vibration		
19	BR3021	Requirement for high impact shock tests for ship board machinery equipment and systems (IN Shock Grade 'A' curves)
20	MIL-STD-167	Mechanical vibrations of shipboard equipment.
21	MIL-STD-740(1&2)	Airborne and structure borne noise measurement and acceptance criteria for ship board equipment
22	NES 810	Design guide for reduction of equipment acoustic noise & Environmental specifications for design
23	DG SHIP S/G/10008	Self-generating, Noise & Vibration of auxiliary machinery, production and refit tests
Documentation		
24	DME 452	Documentation specification
25	IETM/CALS	Electronic format for documentation
NBCD		
26	INBR 312	NBCD guideline for new construction ship
27	BR 2170	NBCD Manual
General		
28	NES 723	Tally / Diagram plates
29	DME 405(R1)	Instrumentation specifications
30	NES 730	Fasteners
31	NES 302	Maintenance Envelope and Removal Routes
32	NES 362	Testing of Equipment & Assemblies after manufacture
33	NES710	Fluid systems, general requirements.
34	ISO1940 Gr 6.3	Dynamic Balancing
35	DGS 251	Painting
NDT/ Chemical & Mechanical Testing		
36	ASTM A388	UT
37	ASTM E272	RT
38	ASTM E165	LPT/DPT
39	ASTME8/ ASTM370/IS1608	Mechanical Testing

	MINISTRY OF DEFENCE (DGQA)	METALLIC EXPANSION JOINTS	PAGE	08
	DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/METALLIC EXPANSION JOINTS/20/2019/REV 0	REV NO	00

SPECIFIC REQUIREMENTS

1. Testing of physical and chemical properties has to be done by NABL accredited lab. (Including firm's NABL accredited lab)
2. If casting is being poured without integral test bar, then the pouring is to be witnessed by Inspector.
3. Radiography is to be carried out for critical regions marked in the approved drawing.
4. Non Destructive Testing is to be carried out by ISNT/ ASNT level II or III qualified technicians.
5. Make of the outsourced Items should be as per approved PIL/Bill of Material (BoM) or Naval approved sources
6. In case of bought out items, physical verification / function of item may be undertaken during assembly of the equipment to avoid repetition.
7. Imported items will be accepted against following import documents:
 - (a) Copy of one among Bill of Lading/Shipping Bill/ Airway Bill.
 - (b) Invoice by OEM or Country of Origin certificate of the equipment with packing list.
 - (c) Bill of Entry for Warehousing
 - (d) The certificate of Conformity (CoC) indicating governing specifications and values to which the items are tested along with Original Equipment Manufacturer (OEM) test certificates/ test reports/ Catalogue/ Data sheet.
 - (e) Guarantee/ Warranteer certificate from the supplier/ OEM as per supply order.
8. If Type Testing have already been done in earlier projects on identical units, it will not be done again & the original reports of earlier tested units will have to be provided for review of Inspection Agency.



MINISTRY OF DEFENCE (DGQA)

METALLIC EXPANSION JOINTS

PAGE

09

DIRECTORATE OF QUALITY
ASSURANCE (WP)
NEW DELHI - 110 011STANDARD QAP NO.
DGQA/DQA(WP)/METALLIC
EXPANSION
JOINTS/20/2019/REV 0

REV NO

00

DATE 19 Nov 19

ABBREVIATIONS

VI	Visual Inspection
DI	Dimensional Inspection
LTC	Lab Test Certificate
STC	Supplier Test Certificate
CC	Conformance/Compliance Certificate
CHP	Customer Hold Point
IR	Inspection Report
NABL	National Accreditation Board For Testing And Calibration of Laboratories
P	Perform
R	Review
W	Witness
TC	Test Certificate
OEM	Original Equipment Manufacturer
DPT	Dye Penetrant Test
MPT	Magnetic Particle Test
SBN	Structure Borne Noise
ABN	Air Borne Noise
FATs	Factory Acceptance Trials
PQR	Procedure Qualification Record
WPS	Welding Procedure Specification
WPQ	Welder Performance Qualification
ETT	Environmental Type Test
ASNT	American Society of Non destructive Testing
ISNT	Indian Society of Non destructive Testing

	MINISTRY OF DEFENCE (DGQA)	METALLIC EXPANSION JOINTS	PAGE	10
	DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/METALLIC EXPANSION JOINTS/20/2019/REV 0	REV NO	00

SCOPE

Scope of Quality Assurance: The scope of Quality Assurance will cover witness and review of all manufacturing activities during all stages viz. raw material stage inspection including, bought out items, in-process stage inspection and final inspection stage. The scope also covers the review and witness of Type Test of equipment, wherever applicable.

This Standard Quality Assurance Plan contains comprehensive list of inspections and/or trials that is to be applicable for quality assurance of the equipment. In addition, quality assurance of equipment will also be governed by specific conditions laid down in SOTRs and 'Approved Drawings'. The inspections/ trials must be contemporary to latest technology/ techniques available in the industry at the time of placement of orders

The following quality assurance activities will be carried out during the quality assurance of equipment:

- (a) Visual Inspection.
- (b) Dimensional Inspection.
- (c) Review of Lab Test Certificates.
- (d) Witness of in-house Lab Testing, if applicable.
- (e) Witness of Non-destructive testing viz. UT,DPT & MPT
- (f) Review of RT films and reports.
- (g) Review of Type Test report wherever applicable.
- (h) Review of draft documentation and witness/ stamping of final documentation, as applicable.
- (i) Issue of CHP clearance.
- (k) Issue of I-Note/ Form-IV or Dispatch Clearance as applicable.

	MINISTRY OF DEFENCE (DGQA)	METALLIC EXPANSION JOINTS	PAGE	11
	DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/METALLIC EXPANSION JOINTS/20/2019/REV 0	REV NO	00

SYSTEM DESCRIPTION

An expansion joint is a device containing one or more rubber/ metal bellow (convolution) used to absorb dimensional changes such as those caused by thermal expansion or contraction of a pipe line, duct or vessel. Expansion Joints (bellows) are elastic vessels that can be compressed when pressure is applied to the outside of the vessel, or extended under vacuum. When the applied pressure or vacuum is released, the below will return to its original shape (provided the material has not been stressed beyond its elastic range) Expansion joints offer elegant solutions for most piping design, problems involving thermal expansion, volume compensation, vibration isolations etc.

Bellows (expansion joints) are one of the most efficient energy absorbing elements for engineering system. Bellows have a function to absorb regular or irregular expansion and contraction in piping system. It is widely used as the element of the expansion joint in various piping system, aerospace, mechanical and industrial system. Bellows are special structures that require high strength as well as good flexibility.

Expansion joints provide flexibility in duct/ piping system and are used for following situations:-

- (a) Expansion or contraction of the duct/ piping system due to temperature changes.
- (b) Isolation of components to minimize the effects of vibration or noise.
- (c) Movement of components during process operation.
- (d) Installation or removal of large components and erection tolerances.

	MINISTRY OF DEFENCE (DGQA)	METALLIC EXPANSION JOINTS	PAGE	12
	DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/METALLIC EXPANSION JOINTS/20/2019/REV 0	REV NO	00
			DATE	19 Nov 19

STANDARD QUALITY ASSURANCE PLAN FOR EXPANSION JOINTS

Part – I: General Information

1. The following generic information must generally be indicated on each QAP as its identity:-

- (a) Equipment Name
- (b) Equipment Technical Details (as applicable)
- (c) Purchase Order Reference
- (d) Sub/Sub-Sub Orders reference (as applicable)
- (e) Name of Main Indenter/ Ordering Authority
- (f) Name of end user
- (g) Name of Firm / Manufacturer
- (h) SOTRs Reference
- (i) Yard No./ Name of Ship where to be fitted (if available)/End User
- (k) References of relevant Drawings
- (l) QAP No. & Date (as indicated by the firm)
- (m) Contractual Delivery Date
- (n) Inspection Authority
- (p) Inspection Agency
- (q) Quantity (as applicable)

Part – II: Technical Inspections / Trials

2. This part of QAP will generally consist of five sections as given below:-

- (a) **Section – I:** Drawing/Documents/ Type tests requirement.

	MINISTRY OF DEFENCE (DGQA)	METALLIC EXPANSION JOINTS	PAGE	13
	DIRECTORATE OF QUALITY ASSURANCE (WP) NEW DELHI - 110 011	STANDARD QAP NO. DGQA/DQA(WP)/METALLIC EXPANSION JOINTS/20/2019/REV 0	REV NO	00

- (b) **Section – II:** Material Inspections for all main/sub assemblies/ components including bought out Item Inspection.
- (c) **Section – III:** In-Process Inspections stage wise.
- (d) **Section – IV:** Pre requisite to final inspection.
- (e) **Section – V:** Final Inspection/Trials including 'Type Tests' as applicable and inspection including verification & recording of weights, marking, preservation, packaging etc.

3. The technical section would normally be in a tabulated format with following columns:-

- (a) Sl. No.
- (b) Component details
- (c) Characteristics / Type of Checks – **list of all applicable checks for that family of equipment.**
- (d) Quantum of check – Sample/100% etc.
- (e) Reference Documents / Acceptance standards – for each check as applicable.
- (f) Format/ Type of Record – CHP/Firm's QA Report etc.
- (g) Agencies.
- (h) Remarks (Inspection details i.e. P – Perform, W – Witness, V/R – Verification / Review, CHP – Customer Hold Point etc.

4. Any additional information as 'Note' may also be included in each section for amplification of requisite tests/trials.

STANDARD QUALITY ASSURANCE PLAN FOR METALLIC EXPANSION JOINTS/ BELLows

<u>SL. NO</u>	<u>MATERIAL/ COMPONENT/ DRG.NO/ QUALITY ACTIVITY</u>	<u>CHARACTERISTIC/ TYPE OF CHECK</u>	<u>QUANTUM OF CHECK</u>	<u>REFERENCE DOCUMENTS</u>	<u>ACCEPTANCE CRITERIA</u>	<u>FORMAT OF RECORD</u>	<u>AGENCIES</u>	<u>REMARK</u>
					<u>FIRM</u>	<u>QAE</u>		
1.00 DRAWINGS/DOCUMENTS OF ASSEMBLY/ SUB ASSEMBLIES								
1.01	Drawings & Documents	Approved Drawings & Design Data sheet	100%	PO, TSP, SOTR, TNC Minutes	PO, TSP, SOTR, TNC Minutes	P	R	As per the Quality Assurance document - "QAD-01" uploaded in DGQA website.
1.02	Type Test Report	Availability	One/ Model	-do-	-do-	Type Test Report	P	Type Test not applicable for Cat 'C' Single Expansion Joint/ Repeat Orders.
*2.00 RAW MATERIALS INSPECTION/ IDENTIFICATION								
2.01	Bellow Backing Ring/ End Pipes Liner Cover Flanges Lugs	Chemical & Physical	01 per size /heat/lot	As per approved drawing	Approved Drawings	NABL TC	P	CHP Samples to be drawn by QAE Reps and tested at NABL lab. Tests may be witnessed by QA reps at their discretion
2.02	COTS ITEMS	Chemical, Physical	01/batch/lot	-do-	-do-	TC/STC	P	CHP
	Fasteners Rope Gaskets							

Note *: Items/ components may vary depending upon type/design and approved drawings of Expansion joints.

STANDARD QUALITY ASSURANCE PLAN FOR METALLIC EXPANSION JOINTS/ BELLows

SL. NO	MATERIAL/ COMPONENT/ DRG.NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA		FORMAT OF RECORD	AGENCIES		REMARKS
					CRITERIA			FIRM	QAE	
3.00	IN PROCESS INSPECTION									-
3.01	WPS & PQR	Welding Procedure & Welder	-	ASME – IX	ASME – IX/ Firm's Internal Procedure/Approved Drawings	Firm's Record	P	R		
3.02	Bellow Tubes	Soundness of welding DP/RT	100%	Approved Drawing/ISOTR	Approved Drawing IHO/Command approved shooting sketch to be provided	TC	P	R	DP/RT to be done on each ply of tube prior bellow formation. DP is required on each ply of welded tube. DP Test to be witnessed by QAE Reps. RT Film to be submitted to QAE.	RT by ASNT/ ISNT level II
3.03	Components of Bellows : Formed Bellows Backing Ring End Pipes Liner Cover Flanges Lugs	Visual Check Dimensional Check DP	100%	Approved Drawings/ISOTR/ PO	Approved Drawings/ SOTR/PO	IR	P	W	CHP	
3.04	COTS Items: Fasteners Rope Gaskets	Visual Checks Dimensional Checks	100%/ Random	Approved Drawings	Approved Drawings/ Specification	STC & IR	P	W	-	

Note 1: Items/ components may vary depending upon type/design and approved drawings of Expansion joints.

STANDARD QUALITY ASSURANCE PLAN FOR METALLIC EXPANSION JOINTS/ BELLows

SL NO	MATERIAL COMPONENT/ DRG.NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF RECORD	AGENCIES		REMARK	
							FIRM	QAE		
4.00 PRE REQUISITE TO FINAL INSPECTION										
		Type Test Report	Type Test Checks (if specified in PO)	01 per (Type/ Model)		Type Test Report			Type Test not applicable for Cat 'C' / Single Expansion Joint/ Repeat Orders.	
4.01	Bellow Assembly	Pressure Test	100% 100%-						When bellow is meant for use in vacuum	
		Vacuum Test							C	
		Life Cycle Testing	01 per (Type/ Model)						H	
		Weight	100%						P	
									Life Cycle Test as per EJMA/ IHQ-MOD(N)/ Command procedure	
5.00 FINAL INSPECTION										
5.01	**Bellow Assembly	Visual Check							Required if included in approved Type Test Plan	
		Dimensional Check	100 %						-	
		DP								
		Axial Expansion, Axial Contraction Lateral in Principal Lateral in Transverse								
		Angular Rotation Stiffness/ Spring Rate Tests:-	01/ Lot/Size	Approved Drgs & Design Data Sheet					Approved Drawings/Design Data Sheet/ SOTR/TNC Minutes/ ATP/ CHP	

STANDARD QUALITY ASSURANCE PLAN FOR METALLIC EXPANSION JOINTS/ BELLows

S.L. NO	MATERIAL/ COMPONENT/ DRG.NO/ QUALITY ACTIVITY	CHARACTERISTIC/ TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA	FORMAT OF	AGENCIES	REMARKS
						RECORD	FIRM	QAE
		Packing, Marking						

Note **: Tests may vary (only applicable tests to be done) depending upon type/design and approved drawings of Expansion Joints.

IMPORTANT NOTE:-

1. **Imported Equipments/ Items:** Inspection will be carried out against the following (minimum) documents:-
 - (a) Copy of one among Bill of Lading/Shipping Bill/ Airway Bill.
 - (b) Invoice by OEM or Country of Origin certificate of the equipment with packing list.
 - (c) Bill of Entry for Warehousing
 - (d) The certificate of Conformity (CoC) indicating governing specifications and values to which the items are tested along with Original Equipment Manufacturer (OEM) test certificates/ test reports/ Catalogue/ Data sheet.
 - (e) Guarantee/ Warranteer certificate from the supplier/ OEM as per supply order.
2. **COTS:** COTS items to be accepted on the basis of Certificate of Conformity (CoC) with following conditions:-
 - (a) Certificate of Conformity (CoC) must indicate governing specifications and values to which the item has been tested. The certificate must include copies of tests reports.
 - (b) In case of manufacturer's certificate under relevant quality standards (like ISO, OHSAS etc), the pre published data sheet or company quality policy bringing out the details of test carried out on specific items may be accepted.
3. **Bought out items:** Bought out items are those which are in the regular production range of the manufacturing firm/ sub vendor and manufactured on placement of specific order by main firm and production is covered by main firm's quality control program.
4. Components/ sub-assembly and their numbers may vary from design to design (from different vendors) therefore only applicable subassemblies/ components details to be incorporated in the drawings/ Bill of material. List mentioned in the SQAP is indicative only. Actual components / items as per approved BOM/ drawings.
5. **Final tests may vary (only applicable tests to be done as per approved drawings/design data sheet/ SOTR /TNC minutes/ ATP) depending upon type/design of Expansion Joints.**

P-Performed, R-Review, V-Verification, W-Witness, CHP-Customer Hold Point, , STC- Supplier Test Certificate , IR-Inspection Report, TC-Test-Certificate

WPS-Welding Procedure Specification, PQR-Performance Qualification Records