

HOSE ASSEMBLY CERTIFICATION AND ACCREDITATION SCHEME

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South African Fluid Power Association.**

**Hose Assembly Accreditation Rev04
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INTRODUCTION

Quality is a key priority and is recognised as the key objective in relation to both product and service to customers.

It is a requirement of this SAFPA certification and accreditation guideline that it be formally implemented to ensure customers receive a quality, qualified hose assembly.

The guideline is essential to assure that only fully certified and approved hose assembly products, assembled in a manner as recommended by the original hose and coupling supplier, are sold to the customer. Where not to specified drawing the hose assembly facility should ensure that replacement hose assemblies are compatible with, and suitable for use with the fluid used and the system. The mixing of collars and inserts from different or unknown suppliers, or the use of unmatched hose and end couplings is potentially dangerous and hence unacceptable. The practice of "Mix and Match" is unacceptable; i.e. components for an assembly must be compatible by design, size, type and manufacture and must have compatibility proved by testing to the appropriate specification. The use of unbranded or unmarked hose or the reworking of used hose is also potentially dangerous and is unacceptable. All hose assembly practices must conform to the manufacturer's recommendations. It should be noted that this procedure does not relate to water jetting hose assemblies as these are governed by separate standards.

The following guideline is the minimum SAFPA requirement for a certified hose assembly facility and forms the basis of the SAFPA "Accredited Hose Assembly Certification" scheme. It should be noted that Customers may have requirements in excess of those contained herein, which may require negotiation between the hose assembly facility and the Customer.



REQUIREMENTS FOR CERTIFICATION

1 Safety, Health and Environmental Issues

- 1.1 It is incumbent upon SAFPA Certified hose assembly facilities to ensure that employees manufacturing flexible hose assemblies are provided with and use appropriate protective clothing (PPE Personal Protective Equipment). These items include:
- Suitable overalls
 - Toe protected boots or shoes
 - Safety spectacles/goggles
 - Impermeable gloves
 - Respirator mask
- 1.2 Hose assembly machinery must be used in compliance with the manufacturer's instructions and be suitably guarded to ensure accidents are avoided. Guards fitted by the equipment supplier must not be removed or tampered with. A fire extinguisher should be readily available for emergency use.
- 1.3 In addition to the above, it is necessary to comply with any additional statutory or legal requirements such as Health and Safety, Fire Regulations the Occupational Health & Safety Act (OHSA) or the Mine Health & Safety Act (MHSA).
- 1.4 Materials shall be disposed of in accordance with Material Data sheets.

2 Quality Assurance

If the company is already quality assured the following key elements shall be included in their "company procedures":

3 Training

- 3.1 It is a requirement that each operator shall be trained on each of the pieces of equipment and assembly procedures to be used and must be fully conversant with the content of this document and where appropriate any specific quality procedures applicable.
- 3.2 A record of operators and the equipment on which they have been trained shall be maintained by the hose assembly facility.
- 3.3 A senior person within the hose assembly facility organisation shall be appointed to train operators and to maintain training records.
- 3.4 Staff shall be trained to a level of competence to interpret Customer's orders and to specify requirements from these.

4 Customer orders (contract review)

- 4.1 When quoting for new business, it is essential that the following be checked:
- 4.2 All engineering specifications stated on the drawing are available and all requirements contained therein can be met.
- 4.3 The tolerances indicated on the Customer's drawing are attainable; if no tolerances are specified, then per manufacturers requirements:
- 4.4 Any amendment to the original Customer order shall be approved by both the Customer and the hose assembly facility and must be recorded.

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4.5 It is imperative that the fluid type being used is known, so that suitable and compatible hose can be selected.

Note: Care should be taken on coupling dimensions where indicated, as these are normally based around the original supplier's product. Also, the method used for the manufacture of hose assemblies on how assemblies are dimensioned and orientated as these can be depicted in a variety of ways.

4.6 Where it is not possible to meet specific Customer's requirements, (e.g. drop dimension on a swept coupling is different), ensure that the Customer is informed in writing and, where authorisation is given to deviate from specification, agreement must be given and noted. Any deviations should be recorded in accordance with the relevant QA procedure and necessary action taken.

5 Goods Receiving

5.1 All goods received by the hose assembly facility should be subjected to the following: Check for the following as a minimum:

- Correct product
- Correct hose and coupling identification
- Shipping damage
- Dispatch paperwork

5.2 Any products found to be incorrect should be held in a quarantine area and identified with a reject label, pending return to the supplier.

5.3 A record of materials received should be maintained for traceability on a stock card or computer. Hose is invariably marked on the outer sleeve and coded, it states manufacturer, type of hose, working pressure and cure date

6 Hold Areas

6.1 Areas within the hose assembly facility premises shall be designated and clearly defined as a goods received area and material rejected or quarantine area.

7 Process Quality Control

7.1 The use of unbranded hose is forbidden. All hose must carry manufacturer's / suppliers name or trademark, cure date and a type, size and working pressure or a type designation / specification.

7.2 The reworking of used hose or the reuse of crimped end fittings is potentially dangerous and is forbidden.

7.3 It is essential that the manufacturers assembly instructions and crimping / swaging data is adhered to implicitly.

An inspection should always be made when using field attachable couplings to ensure that the socket is correctly fitted to the hose, before any attempt is made to fit the insert according to manufacturers assembly instructions.

7.4 The following items should be checked during the manufacture of hose assemblies:

- Hose type and size against works order (check each coil)
- Each coupling and type against works order and manufacturer's recommendations.
- Cut hose: First off and to a sample plan. Cut length to specification.
- Skived hose: First off and to a sample plan. Skive lengths are to manufacturer's recommendations.

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- Hose should be appropriately cleaned: Blow out hose with compressed air or projectile before assembly.
- Coupling cleanliness.
- Where appropriate, the coupling parts are lubricated in accordance with the manufacturer's recommendations.
- Hose protection is fitted (if required)
- Crimped / swaged coupling sizes: First off and every tenth coupling verified against manufacturer's recommendations, results to be recorded
The sampling interval can be increased depending on machine capability index of crimper , $C_{mk} \Rightarrow 1,67$, and proof of such capability studies having been undertaken exist.
- Reusable couplings are subjected to 100% visual inspection after assembly to ensure the fitting is correct.
- Assembly identified, as to manufacturer's manufacturing date code. (yy/mm) or date , maximum working pressure (Bar or MPa) and job or part number (voluntary) requested. The affixing of this information is left to the individual manufacturer.
- The appropriate pressure testing plan has been carried out and recorded.
- The hose assemblies meet the customer's specification for cleanliness (where required).

8 Final Inspection

- 8.1 Final inspection records and assembly protection are recorded.
- 8.2 Hose assemblies have been cleaned by blowing out with compressed air, inert gas, or by other suitable method. Hose assemblies may be rinsed through with a solution of nitrate-free neutral liquid cleaner, or similar fluid.

Final inspection shall be carried out and recorded. Ensure hose assemblies meet specification and have been examined for:

- Internally (where possible) and externally for cuts, bulges etc.
- Ensure nuts swivel freely.
- Check hose guards are fitted, if required.

- 8.3 Labelled and protected as appropriate (dust caps are fitted, bagged or protected etc.)

9 Sampling Plan (As per customer's requirement)

The sampling plan (Appendix 1) is a practical method of assuring the quality of a product without 100% inspection. The plan is based on zero per cent defective, which is normally accepted by the industry unless there are special contractual requirements when the customer may stipulate the inspection levels required.

10 Production Equipment Requirements

- 10.1 The following is the minimum equipment required for the successful production of quality hose assemblies:
- Good quality steel tape measure
 - Vee or support rail (for the accurate measure and cutting of hoses)
 - Cutting machine (a system of producing a straight, accurate and clean hose cut)
NOT an angle grinder or abrasive cutting wheel
 - Skiving or brushing equipment (if required by the fitting type)
 - Means of setting and measuring orientation.
 - Compressed air supply

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- Swaging / crimping machine (with suitable dies for the hose size and type used. and / or
- Hose assembly equipment (for use with reusable couplings, if this type is used)
- Quick reference charts (cross reference charts for swage diameters, die sizes and skive lengths for hose and fitting being used in accordance with the manufacturers guidelines.

11 Test and Inspection Equipment Requirements

11.1 The following equipment is the minimum requirement necessary to ensure the outgoing quality levels which meet the customer's requirements for assembly.

- 0 -25mm micrometer
- 25-50mm micrometer.
- 150mm vernier suitably modified.
- Means of measuring orientation.
- Means of measuring length (e.g. good quality tape measure plus vee support.
- Gauges to test for internal collapse of insert (for straight couplings) where appropriate in accordance with the fitting manufacturers guidelines for assembly.
- Vernier check slips.

11.2 Pressure testing equipment.

12 Additional Requirements

12.1 Calibration system or contract service.

12.2 Identification labels. As applicable.

12.3 Quality records: Inspection and test.

12.4 Certificates.

12.5 Hose assembly part number tags, means of marking, or stamping identification on hose assemblies.

12.6 Hose and end fitting assembly lubrication fluid.

12.7 The equipment listed above is required at each of the hose assembly facility depots. The only exception to this is the vernier check slips. It is only necessary for a hose assembly facility to hold one set of these providing the following points are maintained:

12.7.1 The depot where the vernier check slips are held must be responsible for maintaining the calibration of verniers.

12.7.2 Each depot must hold the calibration records for verniers that are the depot's responsibility, along with a copy of the calibration certificate for the vernier check slips.

13 Calibration of Test, Inspection and Production Equipment

- 13.1 Equipment used to confirm that a product meets the required standard must also be checked at regular intervals to ensure that it is in a fit condition and that the information it provides is acceptable. This is done by checking the equipment against a standard, traceable to a National Standard. It is therefore mandatory that the Distributor must have a calibration system, part of which will be carried by the Distributor and part by services external to the Distributor's company but the control and responsibility of the calibration lies with the Distributor.
- 13.2 The list below identifies the equipment requiring calibration to satisfy the requirements of a SAFPA certified Distributor. Calibration of equipment not noted below remains the responsibility of the Distributor.

	Equipment	Method	Frequency
1)	Micrometers	Mic. Check Slips	If applicable: 6 or 12 months or depending on use
2)	Verniers	Mic. Check Slips BS 870	2 weeks
3)	Mic. Check Slips	Manufacturer or Test House	Once a year
4)	Crimping / Swaging machines	Calibration crimp shell + mic.	Service 12 monthly max. or period laid down in operating manual
5)	Pressure Test Equipment	Manufacturer or by qualified personnel	Service (12 monthly). If used frequently, the standby gauge to be changed at regular intervals and spare calibrated.

- 13.3 The above are the maximum periods when the equipment should be calibrated; customers may require that the frequency should be increased or the results may also indicate that the periods should be changed. The above is based on normal usage; if any of the above is subjected to abnormal use, e.g. vernier dropped on floor or crimper jammed, then the equipment must be calibrated before reusing.
- 13.4 All equipment requiring calibrating shall be issued with a unique number and the information recorded on a master list
- 13.5 Each piece of equipment on the master list shall be checked and calibrated in accordance with the laid down frequency within the policy. Information obtained during the calibration of equipment should be recorded onto an individual calibration sheet. Any adjustments or repairs carried out should be recorded on the sheet.
- 13.6 All reports on servicing or calibration carried out externally, should be retained to enable demonstration to external parties that the maintenance of equipment is an ongoing practice by the distributor. External services must be to a recognised and approved national and international standard.
- 13.7 Appendix 2 is an example of a typical calibration record sheet.

14 Testing & Final Inspection

- 14.1 Assemblies manufactured by a distributor can be defined into two categories:
- Over the counter: Using the failed hose as a master. Normally one-off in quantity.
 - To customer order. In accordance with a customer order to a drawing, written description or pattern sample. Can be one-off or more.

Note: Rework of used hose should not be undertaken at any time. Re-ended hoses are not to be used at any time, since they will not conform to safety standards for fluid power systems and their components. Flexible hose assemblies shall not be constructed from hoses which have been previously used as part of a hose assembly. The practice of fitting ends to previously used hydraulic hose or assemblies is also forbidden.

- 14.2 The use of a disclaimer does not negate the operator of their responsibility, in the event of a hose assembly failure.

- 14.3 Where a distributor is only involved in category 1 type work, it is necessary that they are able to demonstrate to third parties, such as potential customers, QA inspectors and legal assessors that reasonable precautions are taken during the manufacture of a hose assembly. This can be done in the following way:

- Ensuring that the replacement hose is at least equal in specification to the sample. Select correct coupling style and termination, check crimp/swage diameter against crimp/swage data supplied by the hose and coupling manufacturer.
- On a regular basis, at least weekly, a supervisor will, at random, select a hose assembly manufactured by the counter staff and subject it to the following checks:

That the replacement assembly is equal to the specification of the sample supplied
That the correct couplings have been assembled and that the assembly length and crimp diameters are correct

Pressure test assembly to EN ISO 7751. Proof pressure standards for one minute according to the sampling plan Appendix 1

Record the information on the record sheet

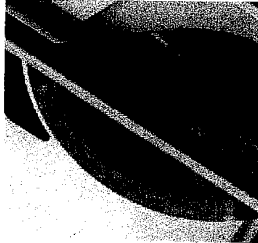
- 14.4 Where a Distributor manufactures to category '2' type work, then each batch should be subjected to a final inspection prior to dispatch. The quantity to be inspected and tested should be in accordance with the sampling plan in Appendix 1 of this document. The following should be checked.

- Hose type, size and date code.
- Correct coupling and crimp diameter or assembly fit.
- Assembly length and orientation.
- Hose protection fitted (where specified).
- Visual appearance of hose and couplings.
- Documentation of pressure test.
- Cleanliness standard (where specified.)
- Correctly protected.
- Manufacturers identification, Date code (yy/mm) or date, maximum pressure (Bar or MPa) and job or part number (voluntary) applied to assemblies.
- Record information on record sheet.

This is in addition to the first off and crimp diameter checks carried out during manufacturing operation.

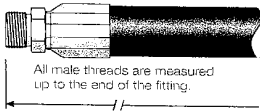
14.5 Hose Assembly Manufacture – Cutting and hose length.

Hose Assembly Manufacture

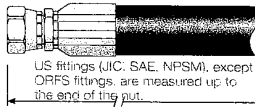


Cutting and hose length

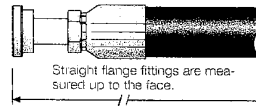
Hose is cut to the desired length according to specifications. The correct hose cutting tool ensures a square, clean cut without damaging the pressure reinforcement. Depending on the hose type, different kinds of blades



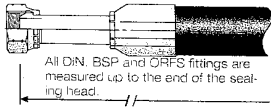
All male threads are measured up to the end of the fitting.



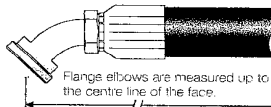
US fittings (JIC, SAE, NPSM), except ORFS fittings, are measured up to the end of the nut.



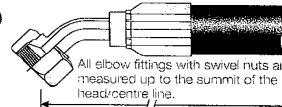
Straight flange fittings are measured up to the face.



All DIN, BSP and ORFS fittings are measured up to the end of the sealing head.



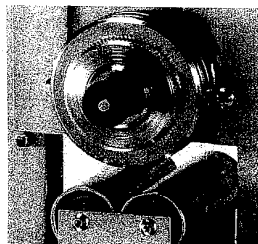
Flange elbows are measured up to the centre line of the face.



All elbow fittings with swivel nuts are measured up to the summit of the head/centre line.

Tolerances for hose assemblies
Length tolerance according to DIN 20066:2002-10 and EN 853 to EN 857

Hose assembly length	up to DN25 (size -10)	from DN32 (size -20) up to DN50 (size -32)	from DN60 (size -40)
up to 630	+7 -3	+12 -4	+25 -6
over 630 up to 1250	+12 -4	+20 -6	
over 1250 up to 2500	+20 -6	+25 -6	
over 2500 up to 8000		+1,5 % -0,5 %	
over 8000		+3 % -1 %	



Marking

According to EN and ISO standards, hose assemblies must be clearly and permanently marked. They must bear the following informations:

- manufacturer's identification
- date of production (year and month)
- maximum permissible working pressure limit of hose assembly



15 Handling, Storage, Preservation & Packaging

- 15.1 The handling of materials from the point of receipt, through manufacturing and test to final dispatch, should be undertaken in such a manner which will prevent damage or deterioration.
- 15.2 The following storage and life expiry recommendations are based on ISO spec. for rubber hoses.
- 15.3 Hose storage should be such that it does not damage or artificially accelerate the normal rate of deterioration. Couplings should be kept in a dry and clean environment. Hose should be kept in a dry environment, out of direct sunlight, not subjected to extremes of temperature nor stored near electric motors nor electric weld equipment that may be operational, or where ozone may be generated or is present.
- 15.4 Thermoplastic hose should be stored to the manufacturer's recommendations.
- 15.5 Hose and hose assemblies should be stored as loose items.
- 15.6 Before fitting, all hose assemblies should be subjected to visual examination for evidence of deterioration.
- 15.7 The Chart below applies to stored rubber hoses and assemblies, depending on their age.

STORAGE & SERVICE LIFE OF HOSE & HOSE ASSEMBLIES

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Shelf Life of Hose				Storage Time of Hose Assemblies		Maximum Service Life of Hose Assembly			
Shelf Life of Hose				Maximum Service Life of Hose Assembly					
Storage Time of Hose Assemblies		Maximum Service Life of Hose Assembly							
Maximum Service Life of Hose Assembly									

Hose assemblies in use must be inspected at least once per year (see 16)

Inspection intervals may have to be shortened due to more onerous operational Requirements or extension of the service life. The reasoning must be documented.

N.B. Other time intervals may apply to thermoplastic hose

- 15.8 Each Distributor should establish their own minimum packaging standard. This should include such items as capping, sleeving, identification labels etc. It should be recognised that many customers have their own packaging specifications and failure to

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meet these requirements can result in rejection. Packaging requirements need to be included in the costing stage.

15.9 Housekeeping should be conducive to good quality.

16 Maintenance

16.1 Distributors should remind customers of the following maintenance requirements:

16.2 Hose and hose assemblies should be subjected to periodic testing/inspection to establish their suitability for continued use. Particular attention should be paid to the condition of the connections and adjacent areas for the appearance of deterioration of hose, due to ageing or damage, maltreatment or accident during use.

16.3 The following defects would be sufficient justification for the withdrawal of hose assemblies from service:

- Puncture
- Localised deformations
- Splits
- Blistering
- Tears
- Swelling
- Exposure of reinforcement
- Soft or sticky patches
- Weathering
- Leakage
- Corrosion affecting integrity of assembly
- Migration of hose out of fitting
- Deformation of fitting affecting integrity of assembly
- Painting of hose (no recognition of markings / tears)

16.4 Where expiry dates can be identified on hose markings against the appropriate external specifications, these should be observed, even if the hose shows no apparent signs of deterioration.



17 Records & Traceability

17.1 Final assembly and pressure test records, when complete, should be passed to the depot office for filing. It is important that these records and any other from of quality record (such as certification and calibration etc.) are filed, so as to be easily retrieved and held in such a manner to assist in the traceability of any material found subsequently to be suspect.

17.2 Record Retention

The following records will be maintained for the periods specified below:

- | | |
|---|---------|
| ▪ Final assembly & pressure test record
(Unless otherwise requested by customer) | 5 years |
| ▪ Certification (supplied by distributor) | 5 years |
| ▪ Calibration records | 5 years |
| ▪ Service contract reports | 5 years |

18 Product information Control

18.1 From time to time it will be necessary for the hose and coupling supplier to update distributors on new products or changes to existing products. Some of this information requires action being taken by distributors or other self-assembly users; e.g. changes to gauge settings and crimp diameters. Therefore it is important that when data information updates, so does it within the company and it is passed on to the self assembly users.

19 Waste & Old Stock Disposal

19.1 The disposal of old stock shall be either by return to the supplier under an agreed procedure, or by scrapping.

19.2 Hose returned to the supplier should be by pre-arranged procedure and accompanied by all appropriate documentation.

19.3 The disposal of scrap hose and hose assemblies is the responsibility of each operator, or of their waste contractor. The disposal of scrap shall be in accordance with, and conform to, local authority by-laws and environmental requirements on the disposal of waste rubber products.

19.4 Waste fluids, used granules, oil pads, rags etc, shall be disposed of by an approved waste contractor (who must comply to the Control of Substances Hazardous to Health regulations 2002 as amended (COSHH regulations)).

Note: Scrapped hose should be disposed of in such a way as to prevent it being used, or offered for use again in a hydraulic fluid power application,

19.5 It is an offence to dispose of waste fluids into drains, or contaminate gullies or ditches by dumping.

20 Acknowledgements

This procedure was adapted from the British Fluid Power Distributors Association Quality Control Procedures and Requirements for the Manufacture of Flexible Hose Assemblies and modified for the South African market and working conditions.

The SAFPA Sub-committee comprised representatives from:-

Alfagomma South Africa (Pty) Ltd

Eaton Hydraulics

Genflex Pty Ltd

H.A.W.

Hydraulic Training & Consultants

Hyflo Southern Africa (Pty) Ltd

Hypress Africa (Pty) Ltd

Kutting SA

Pirtek

21 Disclaimer and Indemnity Clause and Waiver Clause.

Disclaimer and Indemnity

The Hose Assembly Certification and Accreditation scheme is a guideline and is the minimum SAFPA

requirement in respect of certified hose assembly facilities. The guideline forms the basis of the SAFPA Accredited Hose Assembly Certification Scheme. It is recorded that members and customers may have requirements which differ or exceed those contained herein. Any member of SAFPA to whom SAFPA issues a certificate shall be deemed and agrees to indemnify SAFPA and its members from any claims, damages or losses which may now or in the future be suffered by any person, entity or property from any cause whatsoever and howsoever arising. Furthermore, any SAFPA certification does not constitute any warranty or representation of any nature whatsoever for the purpose for which the certificate is issued, either express or implied, including but not limited to a warranty or representation as to quality or fitness of any product or service for a particular use or purpose.

Waiver

No member shall have any claim against SAFPA, or its members arising from the Hose Assembly Certification and Accreditation scheme and guideline, or any certificate issued by SAFPA, whether for any loss or damage to any person, entity or property, or any other cause whatsoever, and any claims, whether now or in the future are hereby waived and abandoned. Each member hereby releases and discharges SAFPA and its members from all claims from whatsoever cause arising.

22 Record of Amendments

Rev. 00 dated 1st October 2009 issued to BFPA for review and comments

Rev -01 dated 7th December 2010 addition cutting & hose length details para 14 pages 9 & 10

Rev – 02 dated 29th March 2011 revision to Introduction page 2

Rev – 03 dated 30th March 2011 page 10 SAE standard deleted

Rev – 04 dated 28th June 2011 page 13 para 21 Disclaimer and Indemnity and Waiver Clauses added. Record of Amendments renumbered to para 22