



# AS BHC MMO Standard for Hydraulic Cylinders



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## 1. INTRODUCTION

AS BHC MMO™ hydraulic cylinders are developed for customers who require a high level of traceability and documentation of materials and manufacturing process procedures used in their products.

### 1.1. Scope

This specification describes requirements for Fabrication, Assembly and Completion of BHC hydraulic cylinders for MMO products, if customer states these on drawings or Purchase Order.

### 1.2. Definitions and Abbreviations

#### 1.2.1. Definitions

IFC	IFC means drawing/ document issued for construction
May	May indicate a course of action that is permissible within the limits of the standard (a permission)
Can	Can-requirements are conditional and indicate a possibility open to the user of the standard.
Shall	Shall is an absolute requirement which shall be followed strictly in order to conform to the standard
Should	Should is a recommendation. Alternative solutions having the same functionality and quality are acceptable

#### 1.2.2. Abbreviations

FII	Free issued items
ITP	Inspection and test plan
IFC	IFC means drawing/ document issued for construction
PO	Purchase order
MRB	Manufacturing Record Book
WPQR	Welding procedure qualification record
WPS	Welding procedure specification
NDT	Non-destructive testing
PWHT	Post Weld Heat Treatment

### 1.3. References

#### 1.3.1. Standards

Below are listed codes, standards and specifications that may be referred to in this specification.

ABS Pub# 152	Lifting Appliances
ABS Pub# 57	Guide for the Classification of Drilling Systems
API 4F	Specification for Drilling and Well Servicing Structures
API 7	Specification for Rotary Drill Stem Components
API 7K	Specification for Drilling and Well Servicing Equipment
API 8C	Drilling Hoisting Equipment

DNV No. 2.22	Lifting Appliances
DNV OS E-101	Drilling Plant
Norsok M-101	Steel structural fabrication
Norsok M-120	Material data sheet for structural steel
Norsok M-501	Surface preparation and protective coating
BS 5244	Recommendations for Application, Storage and Life Expiry of Hydraulic Rubber Hose and Assemblies
BSI BS 5493	Code of practice for protection of iron and steel structures against corrosion
EN-ISO 9606	Qualification testing of welders - Fusion welding
EN 287	Approval testing of welders - Fusion welding
EN ISO 17637	Non-Destructive Examination of welds - Visual Examination
EN 1011	Welding - Recommendations for welding metallic materials
EN 1395	Thermal spraying - Acceptance inspection of thermal spraying equipment
EN 10025	Hot rolled products of structural steels
EN 10204	Metallic products - Types of inspection documents
EN 10210	Hot finished structural hollow sections of non-alloy and fine grain structural steels
EN 10219	Cold formed welded structural hollow sections of non-alloy and fine grain steel
EN 10225	Weldable structural steels for fixed offshore structures
EN ISO 5817	Arc welded joints in steel - Guidance on quality levels for imperfections
EN ISO 3834	Quality requirements for fusion welding of metallic materials
EN ISO 9000	Quality Systems - Model for quality assurance
EN ISO 13920	Welding - General tolerances for welded constructions
EN ISO 14919	Thermal spraying - Wires, rods and cords for flame and arc spraying
EN ISO 15614	Specification and qualification of welding procedures for metallic materials
ISO 898	Mechanical properties of fasteners made of carbon steel and alloy steel.
EN ISO 14713-1	Zinc coatings- Guidelines and recommendations for the protection against corrosion of iron and steel structures. - Part 1: General principles of design and corrosion resistance
EN ISO 14713-2	Zinc coatings- Guidelines and recommendations for the protection against corrosion of iron and steel structures. Part 2: Hot dip galvanizing
EN ISO 1461	Metallic coatings - Hot dip galvanized coatings on fabricated ferrous Products
ISO 2768	Tolerances for linear and angular dimensions without individual tolerance Indications

NS 5820	Contractor`s documentation of equipment
ISO 4624	Paint and Varnishes - Pull-off test for adhesion
ISO 8501-1	Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness
ISO 8501-2	Preparation of steel substrates before application of paints and related products - Test for the assessment of surface cleanliness
EN ISO 8501-3	Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast cleaned substrates
EN ISO 8503-4	Preparation of steel substrates before application of paints and related products - Surface preparation methods
ISO 8573	Compressed Air
ISO 4406	Hydraulic fluid power- Fluids- Method for coding the level of contamination by solid particles
EN ISO 9712	Non-destructive testing - Qualification and certification of personnel
EN ISO 19901-5	Weight control during engineering and construction

### ***1.3.2. Procedures***

Additionally to this internal fabrication standard, BHC has various selections of procedures for how to design and fabricate different equipment. These are company procedures and shall be followed independently of type products/components. Deviation from these standards is allowed only if specified so in the purchase order.

## **2. QUALITY ASSURANCE**

### **2.1. General**

All the work performed by BHC are in compliance with and implemented quality assurance system, based on the requirements of the EN-ISO 9001:2015 standard.

### **2.2. Deviation from Specification**

All deviations or technical queries shall be addressed to the purchaser. No work is to be started before a solution has been found. Purchaser shall give a written response to the deviation/ query.

### **2.3. Inspection and Test Plan (ITP)**

To assure the product quality every project shall have an Inspection and test plan (ITP).

### **2.4. Progress Plan**

Production and progress plans are established for all MMO product deliveries.



### 3. MATERIALS

#### 3.1. General

All structural materials delivered at site are checked against valid specifications and certificates and are recorded in accordance.

The minimum design temperature is -20°C on all steel elements.

The surface roughness of the tube (Ra) must not be more than 0.4micron for H8 tube and not be more than 0.8micron for H9 tube.

The steel specified in drawings and specifications are delivered in accordance with the requirements in the relevant material standard, normally EN 10025.

All outsourcing details must conform to BHC drawings.

All materials of the outsourcing details must have a raw material certificate 3.1. and have to be made according to the BHC requirement indicated in the drawing.

#### 3.2. Materials

All materials are adequately protected during procurement, storage and fabrication. Some formation of rust during fabrication may be accepted, but during fabrication the rust grade shall be within the limits of ISO 8501-1 grade B.

#### 3.3. Marking and Identification

All materials are identified according to the identification system. This system is to ensure that only controlled materials of correct grade are installed, and to ensure historical traceability.

#### 3.4. Certification

All materials in category “**essential**” and “**primary**” are supplied with certificates according to EN-10204 type 3.1.

All raw materials arriving at the BHC must be certified. BHC does not use raw materials that do not have proper certification.

Type 3.2 is applicable for special load bearing components according to classification regulations or PO requirements.

Type 2.2 certificates are accepted for materials of "**secondary**" steel purposes, i.e., steels for non-load carrying purposes like brackets, protection covers, signs etc. Certificates for secondary steels are recorded the same way as Type 3.1 and 3.2 certificates.



BHC kept manufacturing record files, for a period minimum 7 years, for the historical traceability.

### **3.5. Substitute Materials**

Substitute materials may be used as long as material properties (yield, tensile, surface roughness, Charpy-V, and elongation) complies as minimum to original specified materials only when its approved by BHC.

If the substitute material is welded, it shall verify that weldability remains equivalent, and have a valid welding procedure.

### **3.6. Reporting of materials traceability**

All used materials shall be reported in Materials traceability reports which are part of project MRB.

## **4. STRUCTURAL ASSEMBLY**

### **4.1. General**

Dimensions shown on drawings are nominal net dimensions. Extra material needed for machining & shrinkage is not taken in account. There must consider if corrections is needed and compensate thereafter prior to start fabrication.

For assembling of structural members workers shall follow shop drawings and fabrication plans, including allowance for shrinkage.

Weld bevels and root gaps shall be within the permitted range of welding procedures.

### **4.2. Preparation and Cutting of Steel**

Cutting and beveling of materials are carried out by thermal cutting or machining. Thermally cut edges are grounded before welding.

### **4.3. Inspection of Fit Up**

The welding supervisor inspect visually the fit-up and check the weld preparations for any surface defects, check the root gap and bevel geometry for compliance with WPS and alignment tolerances.

### **4.4. Thermal Straightening**

Out of tolerance members can be straightened by locally applied heat. Heating has to be carried out under strict controlled conditions to prevent degradations of steel properties.

The temperature of heated areas is checked by the operator using temp-sticks or other suitable means during the heating.

The heating is performed by means of special torches/burners suitable for the purpose. For structural steel, the temperature shall normally not exceed 590°C except being qualified by a separate procedure.

The parts to be heated for straightening shall be free of stress and external forces, except stresses resulting from mechanical means used in conjunction with the application of heat.

Thermal straightening process may be repeated maximum twice at same place.

The straightened areas shall be subject for 100% MT.

## 5. WELDING

### 5.1. General

All welding works are based on the recommendations given in EN 1011.

Welding devices including instruments are maintained and calibrated according to BHC quality system.

All welding works take place according to established WPS's based on qualified procedures (WPQR's).

### 5.2. Qualification

Welders and welding operators are qualified in accordance with relevant part of EN ISO 9606.

Each welder is assigned identity code which allows traceability of welders in the Weld & NDT records.

BHC keep a continuously updated record of all welder's qualifications, listing their approval categories and expire dates.

### 5.3. Procedures

All welding procedures are prepared in accordance with EN 15614 series or AWS D 1.1, and this specification for all structural welding, including repair welding.

The qualification (WPQR's) is primarily valid for the workshop performing the welding test, and other workshop under the same technical and quality management. It may also be transferred to and used by a subcontractor, provided the principles of EN ISO 3834 are implemented and documented.

New qualification test is required if the carbon equivalent for the steel to be welded increase more than 0.03 carbon equivalent units (IIW formula) over the value of the existing welding procedure qualification record (WPQR).

Formula for Carbon equivalent (CEQ).

$$Ceq = C + \frac{Mn}{6} + \frac{Mo + V + Cr}{5} + \frac{Ni + Cu}{15}$$

All WPS number are recorded in Weld & NDT log.

### 5.4. Consumables

All welding consumables (e.g. wire, rods and powder etc) are stored in a proper manner and according to established instruction/ routines in a dry and safe storage area.

Also all welding consumables shall be meet the requirements for mechanical properties as specified for the welding procedure qualification. Only

consumables listed in DNV “Register of type approved products no. 2” or ABS “Approved Welding Consumables” are accepted.

### **5.5. Preheat and Interpass Temperatures**

Preheating above 50°C shall be achieved by electric heating elements. Cutting torches are not used for preheating.

The minimum interpass temperature shall not drop below the minimum required preheat temperature. If not stated otherwise in the WPS, the maximum interpass temperature shall not exceed 250°C measured at the edge of the groove. For C-and C/Mn -steels, a maximum interpass temperature of 250°C may be used, even if a lower temperature was recorded in the WPQR.

### **5.6. Post Weld Heat Treatment (PWHT)**

PWHT shall be required for structural weld when the nominal thickness (as defined in EN 15614-1) exceeds 50 mm, unless adequate fracture toughness can be documented in the as welded conditions. For restrained joints of complicated design, PWHT may be required for smaller thickness.

PWHT shall be carried out in accordance with a procedure specification which shall include:

- heating rate
- cooling rate
- soak temperatures and time
- heating facilities
- insulation
- control devices
- recording equipment
- configuration of structure to be PWHT or details if local PWHT shall be carried out
- number and location of thermocouples to be used during PWHT

The holding temperature shall normally not exceed 620°C or as recommended by the steel contractor. The soaking time shall be 2.5 min per mm thickness.

The temperature difference between parts of the structure during soaking time shall not exceed 30°C within the heated area. Double-sided heating shall be used as far as possible.

If PWHT is required according to PO then only pre-qualified PWHT procedures are used.

### **5.7. Identification**

For traceability unique numbering system are used to each individual drawing for welds in category “Essential” and “Primary” and a group numbering system for welds in category “Secondary”.

The numbering system are used for identification in Weld & NDT log.

### **5.8. Repairs**

Welds where defects are exceeding the acceptance criteria for Non Destructive Testing shall be repaired.

The preheat temperatures used during repair welding shall be minimum 50°C higher than preheat used for the original weld.

All repair work shall be carried out according to the repair procedures. The procedure includes the method of defect location and removal, preparation of weld area, and NDT before and after re-welding.

#### ***5.8.1. Repair and grinding***

Surface defects may be repaired by grinding, provided the thickness is not reduced by more than 7% of the nominal thickness, or 3 mm, whichever the lesser.

The defective area shall be ground smooth and 100% checked with MT.

#### ***5.8.2. Repair by welding***

Defects deeper than 7% or 3 mm shall be repaired by welding.

Prior to excavation, the NDT operator shall mark the exact location and depth of the defect on the metal surface.

The defective material shall then be removed by machining, or by air arc gouging followed by grinding to sound metal.

After completed excavation and grinding, the suspected area shall be 100% examined by MPI. No repair shall be shorter than 100 mm in defects longitudinal plane.

Repair welding may be performed according to the original weld procedure, provided the essential variables have not been changed, in which case a new weld procedure shall be established.

The repair weld shall be given the same weld number with the suffix R1, R2 etc. to permit traceability of NDT. It shall then be subject to 100% NDT by all applicable methods. The retested areas shall be the full excavated +100 mm in each end.

The same area shall be not repaired more than twice.

## 6. NON DESTRUCTIVE TESTING (NDT)

### 6.1. General

All NDT shall be performed in accordance with written procedures, approved by the Contractors/ Sub-contractors responsible “level 3” person. (ISO 9712 Certification level 3, or equivalent).

Visual examination shall be performed according to EN ISO 17637 and to this specification’s normative references.

NDT shall not commence before 24 hours after completed welding.

### 6.2. Extent

NDT of structural welds shall be in accordance with the next table. Inspection category and scope of NDT will be specified on IFC drawings and on PO.

Category of member	Types of connection	Test method			
		Visual inspection	Magnetic particle <sup>1)</sup>	Radiography <sup>2)</sup>	Ultrasonic
Essential	Butt weld	100%	100%	100%	-
	Cross-and T-joints, full penetration welds	100%	100%	-	100%
	Cross-and T-joints, partial penetration and fillet welds	100%	100%	-	-
Primary	Butt weld	100%	20%	20%	-
	Cross-and T-joints, full penetration welds	100%	20%	-	20%
	Cross-and T-joints, partial penetration and fillet welds	100%	20%	-	-
Secondary	Butt weld	100%	spot <sup>3)</sup>	spot <sup>3)</sup>	
	Cross-and T-joints, full penetration welds	100%	spot <sup>3)</sup>		spot <sup>3)</sup>
	Cross-and T-joints, partial penetration and fillet welds	100%	spot <sup>3)</sup>		

1) Liquid penetrant testing to be adopted for non ferromagnetic materials.  
2) May be partly or wholly replaced by ultrasonic testing upon agreement.  
3) Approximately 2 to 5%.

For product that is by: drawings, specification, data sheet, or purchase order - specified to comply with ABS-CDS or ABS - MODU the NDT shall be carried out as per AWS section 6.

### 6.3. Inspection Status

For identification of NDT status are used “Weld and NDT log.” There are shown conformance, non-conformance, current inspection status and final inspection status.

### 6.4. Personnel

All inspection personnel (VT/PT/MT/UT/RT) shall (as a minimum) be certified according to ISO 9712 level 2 or equivalent certification scheme, accepted by purchaser.

### **6.5. Reporting**

All final NDT shall be reported in a manner which ensures traceability and reproducibility. Examined parts of welds where less than 100% extent is required, shall be marked as to where NDT is carried out.

In addition to requirements given in DNV/AWS rules, the NDT-report shall contain information about: Project, Drawing no., and revision, weld no. and location.

### **6.6. Acceptance Criteria**

Acceptance criteria shall be according to specified requirements ref. Drawings and rules for the actual classification society. For visual examination, the weld quality shall comply with EN ISO 5817 - level C. For usual examination, testing the weld quality shall comply with EN ISO 5817, level B and for visual examination - level C.





## **7. MACHINING**

### **7.1. General**

All dimensions and tolerances (linear, angular, surface, etc.) are to be in accordance with the drawings.

### **7.2. Tolerances**

Machining tolerances shall (if not stated otherwise on drawings) meet requirements stated in ISO 2768-1, tolerance class Medium.

Work pieces exceeding the general or specified tolerances are to be rejected, if not the aberration/ deviation is approved by Purchaser. An approval can be obtained by following the instructions in each individual Purchase Order.

## **8. DIMENSIONAL CONTROL**

### **8.1. General**

All dimensional control in accordance with:

- ISO 2768-1, tolerance class Medium - for machined products, and
- EN ISO 13920 Class A and E for welded products to ensure that dimension tolerances are met.

### **8.2. Tolerances**

Tolerances for overall dimensions, special components, and interface points to equipment, or to other structures, will be specified on IFC drawings. All these dimensions shall be verified and recorded and be a part of the final fabrication documentation.

### **8.3. Measuring Equipment**

All measuring equipment shall be calibrated and certified with traceability to international standards. Calibration certificates are available for review by purchaser or certifying authority.

### **8.4. Documentation**

All dimensional control shall be recorded and documented. They will be a part of project MRB

## **9. ASSEMBLY**

### **9.1. Mechanical assembly**

#### ***9.1.1. General***

Mechanical Assembly work shall be executed in a clean area separated from steelwork such as grinding, welding and blasting.

Assembly of components shall be carried out in accordance with instructions given in assembly drawings, part lists and assembly instruction.

All BHC product are tested accordance to ISO 10100.

#### ***9.1.2. Fasteners in general***

Material property class in fasteners below 8.8 shall not be used. 8.8 fasteners shall be supplied with material certificate 2.2- batch traceability.

Material property class above 10.9 shall be avoided. 10.9 fasteners shall be supplied with material certificate 3.1- batch traceability.

Bolts, nuts and washers  $\leq$  d10 mm shall be of stainless steel (A4) quality.

Bolts, nuts and washers  $\geq$  d12 mm shall be hot dip galvanized (tZn) quality.

Protrusion of bolt ends for Standard Nuts shall be minimum three (3) threads.

Protrusion of bolt ends for Lock Nuts shall be minimum three (3) threads.

Split pin holes and wire holes in bolts, screws and studs for securing wire shall be located according to standard ISO 7378:1983.

Plain Washers, normal-series, product- grade A shall be delivered in the 200 HV and 300 HV hardness classes and of nominal sizes.

Washers 200 HV shall be used in hexagon bolts and screws of product grade A and B up to and including property class 8.8 and nut grade 8, and hexagon bolts, screws and nuts of stainless steel of similar chemical composition.

Washers 300 HV shall be used in hexagon bolt and screws of product grad A and B up to and including property class 10.9 and nut grade 10.

Material grade in fasteners (Bolts, nuts, washers etc.) must be specified in PO.

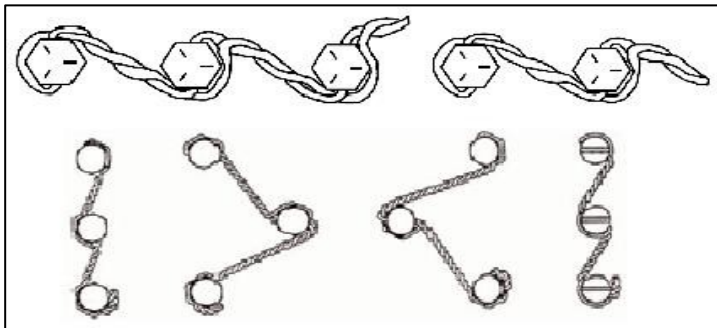
### 9.1.3. Safety Lock Wire Procedure Detail

Wire ties are the most frequently used locking method for bolted connections to prevent them from loosening due to vibration and loading conditions, or tampering.

Using this method must be specified in PO.

The twisted wire is thread through the hole in the fastener and secured in the next bolt or adjacent structure, so the bolt cannot rotate loose.

The use of safety wire is illustrated in the figure below:

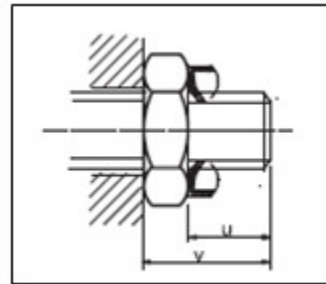
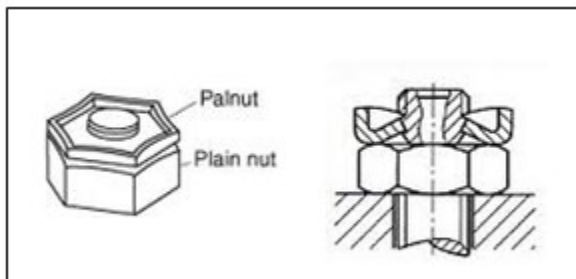


- 1) No more than three (3) bolts may be tied together
- 2) Groups which are situated far from each other shall not be serial linked. Securing wire shall not be used to secure nuts, bolts etc. that are further than 150 mm from each other, unless the wire is attached to an adjacent part of the structure so that the strain on the wire is less than 150 mm.
- 3) Bolt heads may be tied as shown only when the female thread receiver is captive.
- 4) Pre-drilled nuts may be tied in a fashion similar to that illustrated with the following conditions.
  - Nuts must be heat-treated
  - Nuts are factory drilled for use with lock wire
- 5) Lock wire must be Stainless Steel 316 of 0.5mm (0.020 inch) diameter, 0.8mm (0.032 inch) diameter, or 1.0 mm (0.042 inch) diameter.
  - Thread sizes of 6 mm (0.25 inch) and smaller use 0.5mm (0.020 inch) wire
  - Thread sizes above 6 mm (0.25 inch) to 12 mm (0.5 inch) use 0.8 mm (0.032 inch) wire.
  - Thread sizes > 12 mm (0.5 inch) use 1.0 mm (0.042 inch) wire.
  - The larger wire may be used in smaller bolts in cases of convenience, but smaller wire must not be used in larger fastener sizes.

- 6) The securing wire must be installed in such a way that it contributes to tighten and hold the part secured in place, counteracting the parts natural tendency to loosen.
- 7) The ends of the securing wire must be bent in, to avoid any personal injury.
- 8) As long as it's practically possible the securing wire shall be placed around the head of the bolt, screw or nut and twisted in such a way that the loop in the wire is close into the contour of the part that is secured with the securing wire.
- 9) Self-locking counter nuts (PAL nuts) are the Company`s preferred method for securing nuts if nothing else is stated on drawing or specification.
- 10) There is normally no need to secure bolts with wire when Self-locking counter nuts (PAL nuts) are installed.

Note: The Self-Locking Counter Nuts (PAL Nut) work in such a manner that they distort under load and return to their original shape in the threaded area because they are made from a spring like steel.

- 1) The main nuts (Plain Nut) to be properly torqued or tensioned.
- 2) The Self Locking Counter Nut (Pal Nut) shall be installed on top with the flat part against the plain nut.



- 3) Tightening the self-locking nut:
  - Screw the Self Locking Counter Nut hand -tight.
  - Give it a final tightening of 1/3 to ½ turn using a spanner
- 4) Inspecting: When the Self Locking Counter Nut has been correct installed, the Hex faces become slightly concave, making visual examination a reliable inspection method.
- 5) Used Self Locking Counter Nut shall not be re-installed but replaced with a new one!



## **10. FREE ISSUED ITEMS**

### **10.1. General**

The purchaser may supply various components (“free issued items”) according to purchase order then BHC is fully responsible for routines for “call off” of the material, according to the field need date.

### **10.2. Reception**

Routines for reception of “free issued items” and report O, S & D (over, short & damage) within 48 hours after reception, to the purchaser. This is to make sure that any damage or deviation, which may have occurred during dispatch/transport, are detected and reported accordingly.

### **10.3. Storage and Handling**

“Free issued items” shall be stored separately and under conditions preventing loss or damage to the material.

### **10.4. Surface Treatment**

“Free issued items” shall when applicable be painted according to next chapter (see Ch. 10).

## **11. SURFACE TREATMENT**

### **11.1. General**

All structural & secondary steel that will be subject to open environment shall in general be coated according to BHC Coating procedure

### **11.2. Storage of Paints and Chemicals**

All coatings and thinners are to be stored in such a way that the materials will be protected from the elements. The temperature inside the paint store will be between +10 - + 20 °C. Concerns both main store and auxiliary store (for daily use).

### **11.3. Painting**

#### ***11.3.1. General***

No carbon steel shall be installed without previous surface preparation and primer application in areas where blast cleaning will be harmful to installed equipment.

Lead or lead chromates are not permitted ingredients in the paint or in the color of the topcoat.

Prior to the application of each coat, a stripe coat shall be applied by brush to all welds, corners, behind angles, edges of beams etc. and areas not fully reachable by spray in order to obtain the specified coverage and thickness.

Each coat shall be applied uniformly over the entire surface and preferably be spray-painted. Skips, runs, sags and drips shall be avoided. Each coat shall be free from pinholes, blisters, holidays or any other paint defects.

Contamination of painted surfaces between coats shall be avoided. Any contamination shall be removed.

#### ***11.3.2. Pretreatment***

Oil, grease etc. to be removed with solvent products The surface shall be free from any foreign matter such as flux, residue, silvers, oil, grease, salt etc. All surfaces will be washed with clean fresh water.

Sharp edges to be rounded by grinding R min= 2mm. Hard surface layers shall be removed by Grinding prior to blast cleaning. Weld spatters to be removed. Rough welds to be smoothed. Areas where grit blasting/ painting is impossible must be clarified with the customer.

#### ***11.3.3. Climatic conditions***

Acceptable climatic conditions for the various products are given in Customers specifications.

The climatic conditions required by the paint manufacturer and client will be achieved by using suitable heaters, humidifiers, dehumidifiers etc.

**11.3.4. Unpainted surface**

The following items shall not be coated unless otherwise specified:

- Stainless steel, chrome plated, copper, brass, plastic and similar;
- Grease nipples and pipe/ tube fittings of stainless steel;
- Machined surfaces, contact surfaces for gaskets, threads;
- Friction surfaces for couplings;
- Tag plates, signs etc.,
- Valve stems, shafts or similar equipment, having surfaces with small working tolerances;
- Measuring instruments, glass etc.;
- Electric/ instrument cables, cable trays;
- Safety equipment;
- Hoses.

**11.3.5. Coating system**

Coating system for MMO products are described below.

System no 1.

This coating system is to be used on hydraulic cylinders.

Pretreatment:	Sharp edges, fillets, corners and welds shall be rounded or smoothed by grinding P3 (ISO 8501-3). All areas to be cleaned thoroughly with strong detergents and high pressure fresh water to remove oil, grease, salt and contaminations.	
Then Apply:	Total Dry Film Thickness mean (DFT)	120
<u>µm DFT</u>		

**11.3.6. Inspection and testing**

Quality control and report for coatings and related activities shall be as specified in project specification, and shall as a minimum include:

- Daily log of environmental conditions (temperature, humidity etc.).
- Inspection of pre-treatment.
- Thickness measurement of each layer.
- Visual inspection.



Testing and inspection will be carried out in accordance with customers and/or BHC's standard or Norsok M-501 and filled into surface treatment report.

For the testing are used different types of inspection equipment's / instruments:

- wet film combs.
- electronic (digital) equipment for measuring dry film, dew point, air temperature, steel temperature, hygrometer (they all can be in one equipment).
- pull-off equipment.

#### **11.3.7. Coating repair system**

The damaged area shall be removed and the edge around the area shall be cut back to solid materials. After removal of damaged coating, the area shall then be painted.

### **CERTIFICATION AND DOCUMENTATION**

#### **11.4. Third Party Certification**

If a third-party society (DNV, ABS, Lloyds, etc.) is nominated, this shall be clearly specified in the purchase order (PO).

If so then certification starts with a pre-start meeting in accordance with the requirements of the nominated society.

At the start meeting shall be agreed the scope and amount of necessary survey, witnessing & certification points. There shall be agreed also QA and ITP plan. Those points are further documented in MRB.

#### **11.5. Manufacturing Record Book (MRB)**

All manufactured equipment shall be documented in compliance with the list below. Extent of documentation shall be specified in the purchase order (PO).

Typical documents required are:

- Document index list
- Suppliers Certificate of Compliance
- Suppliers Inspection and Test Plan (ITP) signed by 3rd party whenever class Requirements.
- 3rd Party Survey Report(s)
- Material traceability list
- Material certificates
- Welding procedure qualification records (WPQR)
- Welding procedure specifications (WPS)

- Welders' approval certificates
- Weld and NDT log
- Weld Repair Procedures, methods, etc. with NDT approval
- PWHT reports
- NDT operators qualification certificate
- NDT technical report
- Visual/ dimensional control reports
- Dimensional reports for all machined parts
- Surface treatment report
- Pressure test reports
- Load test reports
- Weight certificate
- Drawings "As-Built", (suppliers "Red Mark-Up" is sufficient).



## **12. PACKING AND MARKING**

### **12.1. Packing**

Packing shall be such as to afford protection against corrosion, ingress of suspended matter, mechanical protection during handling operations and any other protection which guarantees the delivery of equipment and/or materials in first class condition from leaving contractors works to completion of installation on site.

### **12.2. Marking**

All products must be covered with a packing film and sealed with a marked tape bearing the letter BHC.

## Version history

Version date	Approved by	Comments
30.01.2018	Kait Lukka	New Document
14.07.2021	Rait Mutle	Corrected text
11.04.2023	Rait Mutle	Improved layout, new logo and simplified and updated text.