

TYPE APPROVAL CERTIFICATE**This is to certify:****That the Hoisting, Rotation and Pipehandling Equipment**with type designation(s)
EXPANDABLE PIN ASSEMBLY

Issued to

Expander System Sweden AB
ÅTVIDABERG, Swedenis found to comply with
DNV-OS-E101 Drilling Plant October 2013**Application :****See page 2**This Certificate is valid until **2019-06-30**.Issued at **Høvik** on **2015-03-25**DNV GL local station: **Stockholm**Approval Engineer: **Morten Wiese**for **DNV GL**

A handwritten signature in blue ink that reads 'P. Esvall'.

Per Esvall
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid. The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

Certificate No: **D-5779**
File No: **523.30**
Job Id: **262.1-014691-2**

Manufacturer:

Expander System Sweden AB
CIM Number 10125317
ÅTVIDABERG, Sweden
Local office: DNV GL Stockholm

Expander Americas Inc.
CIM Number 10125356
Cottonwood, United States
Local office: DNV GL Long Beach, CA

Responsibility

The Expander System Sweden AB takes responsibility that both design and production are in compliance with the Rules, Standards and/or Regulations listed on page 1 of this Type Approval Certificate.

Product description

The Expander system (expandable pin assembly) is a pivot assembly for securing a pair of mounting lugs and stabilizing a machine member. The machine member is often a bearing or a bushing. The system consists of an axle with tapered ends and a locking mechanism on each side. The locking mechanism comprises a sleeve and a bolt or a nut and sometimes a tension washer. When a force is applied to the sleeve via the fastener or the washer, the tapered end of the axle will work as a guide for the sleeve, and it will expand radially. A high tension is established in the contact material of the axle, sleeve and lug ear. The tension causes friction between the tapered axle end and the sleeve, and between the sleeve and lug ear. The friction between these surfaces creates a very strong locking of the expander system.

Reference Standards

- DNV-STC-2.22 « Lifting Appliances »
- API 8C « Specification for Drilling and Production Hoisting Equipment” 5th ed. April 2012.
- DNV GL's understanding and interpretation of PSA's "Regulations relating to design and outfitting of the facilities etc. in the petroleum activities" (The Facilities Regulations) Ch. VIII, December 2013.

Application/Limitation

<u>Design Parameter</u>	<u>Range</u>	<u>Description/Options</u>
Straight pin		
Internal thread and bolt	Single bolt	Without internal greasing
	Single bolt	With internal greasing (one or two outlets)
External thread and nut	Multi bolt	Without internal greasing
	Multi bolt	With internal greasing (one or two outlets)
	Single bolt	Without internal greasing
	Single bolt	With internal greasing (one or two outlets)
Through bolt	Single bolt	Without internal greasing
Pin outside diameter range Safe Working Load (SWL)	Single bolt	With internal greasing (one or two outlets)
	20mm – 406.4mm Up to 5000 tonnes	
Stepped pin		
Internal thread and bolt	Single bolt	Without internal greasing
	Single bolt	With internal greasing (one or two outlets)
	Multi bolt	Without internal greasing
	Multi bolt	With internal greasing (one or two outlets)
External thread and nut	Single bolt	Without internal greasing
	Single bolt	With internal greasing (one or two outlets)
	Single bolt	Without internal greasing
Pin outside diameter range Safe Working Load (SWL)	20mm – 406.4mm	
	Up to 5000 tonnes	

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Type Approval documentation

<u>Drwg./Doc. No.</u>	<u>Rev.</u>	<u>Title</u>
DNV-EXP001	5	Design Calculations
DNV-EXP002	3	Material Specification
DNV-EXP003	3	Design Calculation Method
		Application for DNV Type approval
SKM-13-1474		DNV Survey report (prototype test) endorsed by DNV Stockholm, date: 2013-04-18 Initial TA survey reports (Expander System Sweden AB, Expander Americas Inc.)
535332:2	1	Prototype test report
DNV-EXP101	0	Straight pin, Internal thread and bolt, Single bolt
DNV-EXP102	0	Straight pin, Internal thread and bolt, Multi bolt
DNV-EXP103	0	Straight pin, External thread and bolt, Single bolt
DNV-EXP104	0	Straight pin, Through bolt, Single bolt
DNV-EXP105	0	Stepped pin, Internal thread and bolt, Single bolt
DNV-EXP106	0	Stepped pin, Internal thread and bolt, Multi bolt
DNV-EXP107	0	Stepped pin, External thread and nut, Single bolt
DVR-262.1-014691-J-2	0	DNV Design verification report

Materials

Each product components are to be Charpy Impact tested according to applicable standards:

<u>Components</u>	<u>Material</u>	<u>Min. Strength</u>	<u>Yield</u>	<u>Charpy (min.)</u>
Axle	SS 2541-03/EN 1.6582/34CrNiMo6/AISI 4340 SS 2244-05/EN 1.7225/42CrMo4V/AISI 4140EN SS 2387-05/EN 1.4418/X4CrNiMo16-5-1 EN1.4542/X5CrNiCuNb17-4/ASTMA564type 630/17-4PH	500-900 N/mm ² (depends on mtrl & dimension)		27**J at -20 ⁰ C 42***J at -20 ⁰ C
Sleeve & Washer	SS 2541-03/EN 1.6582/34CrNiMo6/AISI 4340 SS 2244-05/EN 1.7225/42CrMo4V/AISI 4140 SS 2172/EN 1.0577/St 52-3/S355J2 AISI 1045 520M 550M SS 2387-05/EN 1.4418/X4CrNiMo16-5-1 EN 1.4542/X5CrNiCuNb17-4/ASTM A564 type 630/17-4PH	275-900 N/mm ² (depends on mtrl & dimension)		N/A
Bolt&Nut	SS 2541-03/EN 1.6582/34CrNiMo6/AISI 4340 8.8 grade (ISO 898-1) A4 80 SS2387-05/EN 1.4418/X4CrNiMo16-5-1 EN 1.4542/X5CrNiCuNb17-4/ASTM A564 type 630/17-4PH	540-800N/mm ² (depends on mtrl & dimension)		27J at -20 ⁰ C

***) Note: This Charpy impact value is according to DNV 2.22

**) Note: This impact property is according to DNV-OS-E101 and API 8C

- Material selection and properties shall comply with applicable standard.
- Method, extent and acceptance criteria of NDE shall be in accordance with applicable standards.
- Axle materials hardened and/or surface treated (for example hard chrome plated, NiCr plated) where applicable according to order specification.

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Documentation which are to accompany each product/delivery

- Material certificate 3.1 type (EN 10204:2004)
- Material Traceability List
- GA drawings with relevant dimensions
- NDT reports
- Installation procedure
- Maintenance procedure

Marking of product

For traceability each product shall be marked in accordance with applicable standards.

1. Conditions and Comments

- This document may be used as part of the documentation required to comply with European Union (EU) Directives referenced in PSA's Acts, regulations and provisions for the petroleum activities. It should however be noted that the scope covered by this document does not necessarily cover all aspects required to issue the EU Declaration of Conformity and to affix the CE-mark. It is the manufacturer's/operator's responsibility to ensure compliance with relevant EU Directives.
- Expandable pin assembly shall be delivered with material certificate equivalent to 3.1 type according to EN 10204:2004. The 3.1 certificate is issued by the manufacturer and is validated by the manufacturer's authorized inspection representative independent of the manufacturing department.
- If DNV certification is required (for bigger sizes or SWL) by End user or state authority then product may be proof tested and surveyed during fabrication in accordance with the requirements specified in the applicable standards and followed by issuance of DNV Survey report.
- Fatigue analysis: End user shall take into account this in each case. Normally fatigue is not a problem for proper pretensioned pin assembly. Bolts shall provide sufficient preload in order to avoid any rotation or slippage of the mating faces during operation and be designed according to Design Calculation DNV-EXP001 Rev.4.
- It is recommended that End user of the product would perform inspection once per annum in order to ensure that preload is sufficient and no loosening occurs.
- Safe working load (SWL) shall be specified by end user.
- Documentation which are to accompany each product/delivery to be kept by manufacturer over a period of at least 10 years.

Certificate Retention Survey

For retention of Type approval, DNV Surveyor shall perform a survey every second year and before the expiry date of this certificate in order to verify that the conditions for the type approval are complied with.

END OF CERTIFICATE