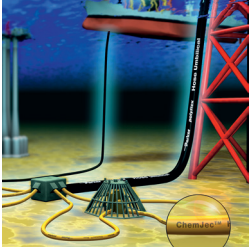
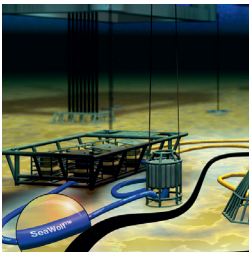
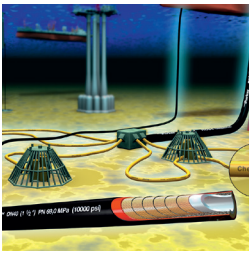




aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding



Black Eagle Product Manual

Catalogue 4466-UK

Parker

ENGINEERING YOUR SUCCESS.

For Your Safety

The hose assemblies listed in this product manual are all special constructions with the hose having up to eight spiral layers of steel wire. Due to this construction, pressures are achieved which far exceed German and international standards. These hose types are manufactured and tested according to the ***polyflex***® standards which have proved to be effective over many years.

polyflex® hose assemblies are used at considerable working pressures. The critical area of a hose assembly is the connection between flexible hose and rigid fitting (crimping area). Only the use of original ***polyflex***® components (hose, fittings and tooling) and full compliance with the ***polyflex***® assembly instructions can guarantee safety and conformity with standards. It is essential that training be given to customers in the hose assembly process in order to make high quality ***polyflex***® maximum pressure hose assemblies.

For the production and testing of the hose assemblies relevant to the applications, the guidelines and technical regulations as well as the protection and hazard prevention rulings must be adhered to.

Manufacturers of ***polyflex***® hose assemblies are obliged to mark these hose assemblies according to the regulations and to verify their safety by a final pressure test.

Non-compliance with these rules can lead to the premature failure of the hose assembly and the loss of warranty.

General table of contents

The content contained in this product manual has been compiled with the greatest care and corresponds to the information currently available to us.

However, we would like to point out that we reserve the right to make technical changes and we kindly request you to contact us should you have any special questions.

Chapter 1

Polyflex Division Europe

1.1 Who is Parker Polyflex?

Parker Hannifin offers an extensive program of systems and components for fluid handling technology. Parker is structured into sales offices and manufacturing divisions to guarantee optimum focus on our customers' demands and market interests at any time.

The Polyflex division, with headquarter located in Hüttenfeld, Germany, provides thermoplastic hoses and tubes. These are applied in a variety of different markets such as standard hydraulics, ultra high pressure applications, and oil & gas industry. As a market leader in many areas and with a unique product range we are pleased to assist you with all your queries.

1.2 ISO 9001 Certificate

DNV·GL

MANAGEMENT SYSTEM CERTIFICATE

Certificate No:
74824-2010-AQ-GER-DAkkS

Initial certification date:
01. July 2010

Valid:
18. October 2017 - 30. June 2019

This is to certify that the management system of

Parker Hannifin Manufacturing Germany GmbH & Co. KG –
Polyflex Division Europe
An der Tuchbleiche 4, 68623 Lampertheim, Germany

has been found to conform to the Quality Management System standard:

ISO 9001:2015

This certificate is valid for the following scope:

Development, production and sales of thermoplastic tubing, high pressure and ultra high pressure hoses and hose assemblies and of the respective fittings and components

Place and date:
Essen, 18. October 2017

DAkkS
Deutsche
Akkreditierungsstelle
D-ZM-18453-01-00

For the issuing office:
DNV GL - Business Assurance
Schnieringshof 14, 45329 Essen, Germany

Thomas Beck
Technical Manager

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.
ACCREDITED UNIT: DNV GL Business Assurance Zertifizierung und Umweltgutachter GmbH, Schnieringshof 14, 45329 Essen, Germany.
TEL: +49 201 7296-222. www.dnvgl.de/assurance

Chapter 2

Black Eagle Hose Series

2.1 Black Eagle Hose series – A unique product for demanding applications

This product manual provides details about design, features, benefits and applications of Black Eagle Hose series. It will help readers and users to identify new solutions for their applications, and also new applications for this unique series of thermoplastic high pressure hoses.

Black Eagle is a hose series of multi-spiral, wire reinforced thermoplastic high pressure hoses specifically designed for the oil and gas market, covering applications in offshore projects and land operations.

For many years this range of hoses has enabled our customers to optimize well completion and production by performing operations like acidizing, cementing, methanol injection or gas injection.

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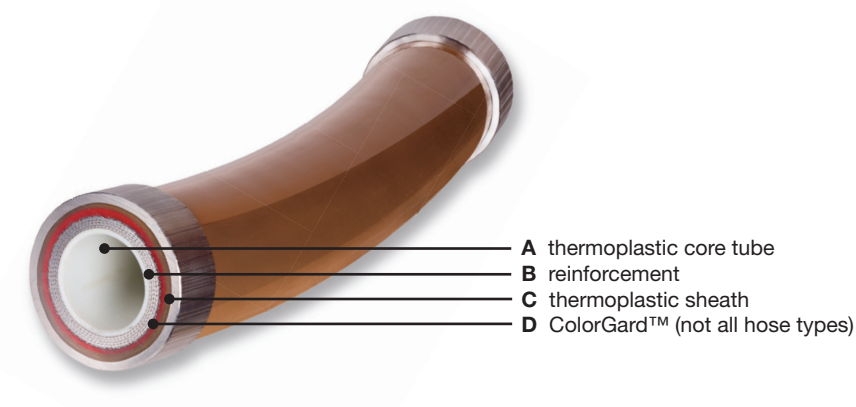
2.2 Design and construction principles



Each operation has a potentially different demand for product features due to a wide variety of application parameter like:

- Composition of fluids
- Temperatures and pressures
- Short term pressure fluctuations
- Static and dynamic loads
- Safety requirements and standards

To cover most of them Polyflex offers Black Eagle in 3 different versions:

- Black Eagle
- Black Eagle Light
- Golden Eagle

All Black Eagle hoses consist of:

- A thermoplastic core tube
- A high tensile steel wire reinforcement
- A thermoplastic sheath

The decision about the type of core tube, number and strength of wires and the type of sheath differentiates the types of Black Eagle hoses and provides unique characteristics

Thermoplastic core tube

The essential requirement for a hose is to contain and transmit a liquid or gas. The core tube of a thermoplastic hose is therefore in direct contact with that liquid or gas. The selection of the core tube material depends on chemical compatibility, service temperature, and diffusion rate under operating conditions:

- Black Eagle: The core tube of Black Eagle is an extruded PA11 tube. This polyamide grade is widely used in the Oil&Gas industry to convey different types of fluids. So it is used in high-performance applications like well injection or fracking. It can operate within a wide range of working temperatures (-40°C up to +70°C), has a high dimensional stability and is low in density.
- Black Eagle Light: It has also a PA11 core tube. The only difference is that it has 2 colored layers – a black inner layer and a yellow outer layer. This feature is called Inner Color-Gard™. It helps to simplify the visual inspection of Black Eagle Light hose assemblies to detect core tube erosion in abrasive applications.
- Golden Eagle: Proprietary fluoropolymer based core tube designed for use in chemical injection systems at high temperature levels. The tubing shows low permeation rates and provides an excellent chemical resistance. Proven to handle methanol at 100°C and 15,000 psi working pressure.

All thermoplastic core tubes are manufactured with an extremely smooth and clean inner surfaces. This provides minimum flow resistance and minimum pressure drop in service.

Spiralized wire reinforcement

Our reinforcement allows flexibility in service without compromising fluid transfer. Various layers of high tensile strength steel wires are used to achieve the best combination of pressure resistance, flexibility, and volumetric expansion.

Thermoplastic sheath

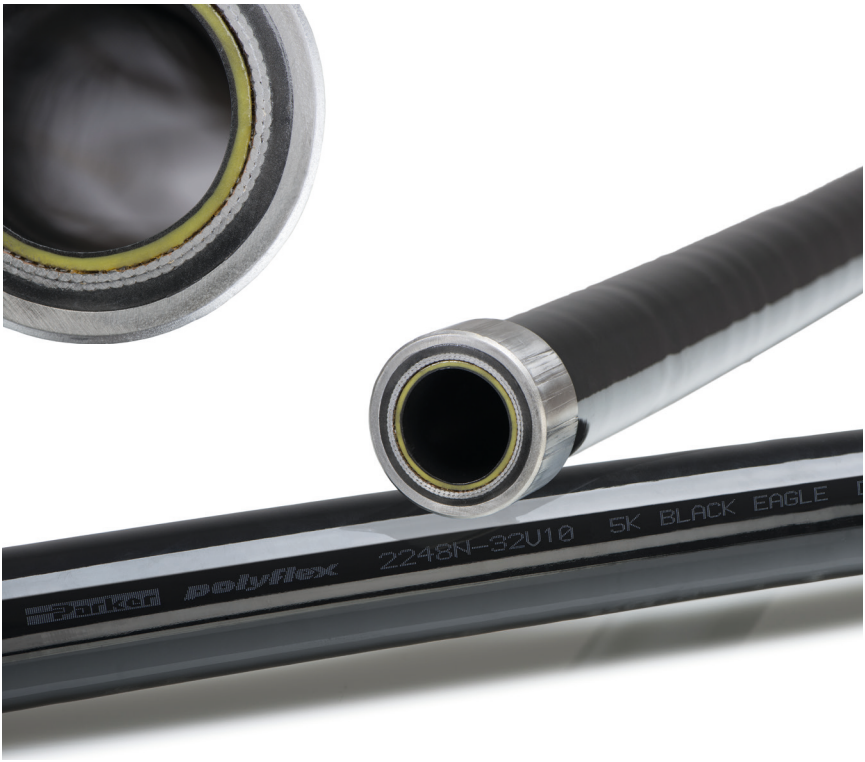
The basic function of the sheath is to protect the wire reinforcement from demanding environmental impacts. This could be corrosive fluids like seawater or extreme abrasive conditions. There are two types of sheaths available.

1. Standard sheath: a thick Polyurethane sheath for abrasive applications like cementing (Black Eagle Light).
2. ColorGard™ sheath: An extra thick dual layer Polyurethane sheath consisting of a red inner layer and a black outer layer (Black Eagle) or golden outer layer (Golden Eagle). It offers both an abrasion resistant extra thick cover for long service life and acts as an additional safety feature. This concept is a visual early warning system for detection of excessive abrasion. This feature avoids possible injuries and reduction of downtime by anticipating failure.

2.3 ColorGard™ - Improve your hose management

ColorGard™, a visual early warning system to detect excessive abrasion of the hose. First implemented only for the sheath, we have it now integrated also on the core tube for the new Black Eagle Light series. Its core tube consists of two different colored layers – a black inner layer and a yellow outer layer. The purpose of this is to provide visibility for potential core tube erosion that may occur during the service life of the hose. Should the inside wall erode, yellow spots or traces along the wall of the liner would become visible during an inspection. By using a borescope, the hose assembly can be properly inspected for tube and fitting wear.

This works very similar to the ColorGard™ feature of Black Eagle and Golden Eagle on the hose sheath. Excessive abrasion becomes visible by red spots on the sheath – easily detected by visual inspection.



2.4 Fittings for Black Eagle hoses

Parker Polyflex provides a large range of fittings for the Black Eagle hoses. Besides Hammerlug unions in different pressure ratings and API flanges, we may also offer customized solutions – please send us your request.

The choice of material depends on several parameters:

- Pressure rating
- Required corrosion resistance

Polyflex provides also the option to choose special alloys. Our team of engineers will find the best solution for you application.

2.5 Examples of Applications

Annulus lines for RWI (Riserless Well Intervention) and High pressure lines in pressure pumping jobs like:

- Well injection (water, gas, chemicals)
- Cementing
- Acidizing
- Fracking
- Mud pumping

2.6 At a glance: Features and Benefits

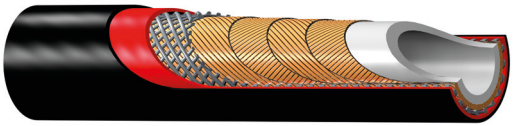
Features	Benefits
ColorGard™, an extra thick dual color Polyurethane sheath or PA11 core tube	Increased safety – superior abrasion resistance in combination with a visual indication for damaged sheaths or core tubes
Long continuous lengths up to 1,500 m without splicing (depending on hose type)	Less connections – therefore less risk of leakage, less risk to workforce, less pressure drop and faster deployment
Superior chemical resistant core tube – either seamless PA11 or fluoropolymer based	Long service life and less maintenance
Compact design – smaller OD than flexible pipe	Less effort for logistics due to increased hose capacity per reel
Up to 30% weight reduction in comparison to R13 rubber hoses – more than 70% in comparison to flexible pipe	Easier handling and faster installation
ID from 1 1/4” up to 3” – working pressure from 3,000 psi (207 bar) up to 15,000 psi (1035 bar) – temperature range from -40°C up to 100°C	Comprehensive range of hoses to cover most applications
Lower bend radius compared to composite hose	Easier handling much better flexibility

Chapter 3

Hose and fittings

3.1 Part number system

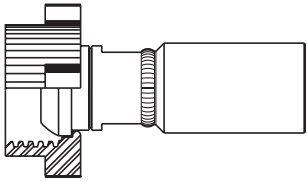
Hoses



2580 N - 32 V80

Hose type	Core tube material	Hose I.D. in 1/16"	Design variation

Fittings



1 HE BL - 32 - 32 - FLAT

Manufacturing location	Connec-tion code	Parker fitting series	Connec-tion size thread/ tube	Hose inner diameter (Dash size)	Additional information

3.2 Hose overview

Black Eagle Light

#	ID		OD	Max. working pressure	Min. burst pressure	Min. bend radius	Max. length	Weight	Ultimate collapse pressure
	size *DN*	inch *mm*	inch *mm*	psi *MPa*	psi *MPa*	inch *mm*	ft *m*	lbs/ft *kg/m*	psi *MPa*
2240N-32V10	-32 *50*	2 *51*	2.70 *68.5*	3,000 *20.7*	12,000 *82.7*	19.7 *500*	3,281 *1000*	2.96 *4.40*	550 *3.8*
2248N-32V10	-32 *50*	2 *51*	2.70 *68.5*	5,000 *34.5*	12,500 *86.2*	19.7 *500*	3,281 *1000*	2.96 *4.40*	550 *3.8*
2449N-32V10	-32 *50*	2 *51*	2.89 *73.5*	8,000 *55.2*	20,000 *138.0*	25.6 *650*	3,281 *1000*	5.14 *7.65*	710 *4.9*

Black Eagle

	size *DN*	inch *mm*	inch *mm*	psi *MPa*	psi *MPa*	inch *mm*	ft *m*	lbs/ft *kg/m*	psi *MPa*
2440N-20V80	-20 *32*	1 1/4 *32.2*	2.19 *55.5*	10,000 *69.0*	25,000 *172.5*	15.8 *400*	4,921 *1500*	2.55 *3.80*	870 *6.0*
2640N-24V80	-24 *40*	1 1/2 *38.0*	2.78 *70.5*	10,000 *69.0*	33,350 *230.0*	19.7 *500*	3,281 *1000*	4.84 *7.20*	950 *6.5*
2640N-24V80-15K	-24 *40*	1 1/2 *38.0*	2.60 *66.0*	15,000 *103.5*	33,750 *233.0*	19.7 *500*	3,281 *1000*	4.37 *6.50*	957 *6.6*
2448N-32V80	-32 *50*	2 *50.5*	3.17 *80.5*	5,000 *34.5*	20,000 *138.0*	19.7 *500*	4,593 *1400*	5.71 *8.50*	710 *4.9*
2580N-32V80	-32 *50*	2 *50.5*	3.33 *84.5*	10,000 *69.0*	25,000 *172.5*	31.5 *800*	4,593 *1400*	6.32 *9.40*	826 *5.7*
2648N-32V80	-32 *50*	2 *50.5*	3.39 *86.0*	15,000 *103.5*	33,750 *233.0*	31.5 *800*	4,101 *1250*	8.13 *12.10*	870 *6.0*
2240N-48V80	-48 *78*	3 *75.0*	4.49 *114.0*	5,000 *34.5*	12,500 *86.2*	40.0 *1000*	1,148 *350*	7.73 *11.50*	290 *2.0*
2440N-48V80	-48 *78*	3 *75.0*	4.80 *122.0*	10,000 *69.0*	20,000 *138.0*	43.3 *1100*	984 *300*	12.57 *18.70*	957 *6.6*
2640N-48V80	-48 *78*	3 *75.0*	5.12 *130.0*	15,000 *103.5*	33,750 *233.0*	47.2 *1200*	820 *250*	18.48 *27.50*	1,160 *8.0*

Golden Eagle

	size *DN*	inch *mm*	inch *mm*	psi *MPa*	psi *MPa*	inch *mm*	ft *m*	lbs/ft *kg/m*	psi *MPa*
2640M-24V88	-24 *40*	1 1/2 *38.0*	2.78 *70.5*	10,000 *69.0*	33,350 *230.0*	19.7 *500*	1,970 *600*	4.84 *7.20*	950 *6.5*
2448M-32V88	-32 *50*	2 *50.5*	3.23 *82.0*	5,000 *34.5*	20,000 *138.0*	19.7 *500*	1,970 *600*	5.71 *8.50*	710 *4.9*
2580M-32V88	-32 *50*	2 *50.5*	3.33 *84.5*	10,000 *69.0*	25,000 *172.5*	31.5 *800*	1,970 *600*	6.32 *9.40*	825 *5.7*

3.4 Hose specifications

2" – 3,000 psi ***Black Eagle*** Light Hose with inner ColorGard™ 2240N-32V10

CONSTRUCTION

Core tube : PA11 with inner ColorGard™
Pressure reinforcement : 2 layers of high tensile steel wire

Cover : Extra thick TPU sheath
Colour : Black

TEMPERATURE RANGE -40°C up to +100°C / -40°F up to 212°F

MAX. LENGTH 1,000 m
For longer length requests please contact Polyflex Division

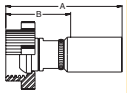
CERTIFICATES DNVGL Type Approval TAD00000CA (see chapter 4)

2240N-32V10

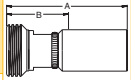
ID		OD		Max. working pressure		Test pressure		Min. burst pressure		Min. bend radius		Weight		Collapse pressure	
mm	inch	mm	inch	MPa	psi	MPa	psi	MPa	psi	mm	inch	kg/m	lbs/ft	MPa	psi
51	2	68.5	2.70	20.7	3,000	31.1	4,500	82.7	12,000	500	19.7	4.4	2.96	3.8	550

Available steel and stainless steel fitting (not suitable for subsea):

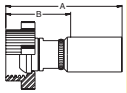
1502 Hammerlug union male — **Material: special steel, zinc plated**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HES6-32-32-FLAT	4 1/8"-3 ACME	207	8.15	113.0	4.45	103.5	15,000	

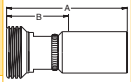
1502 Hammerlug union female — **Material: special steel, zinc plated**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HNS6-32-32	4 1/8"-3 ACME	190	7.50	94.4	3.80	103.5	15,000	

1502 Hammerlug union male — **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HES6-32-32-FLAT-SC	4 1/8"-3 ACME	207.0	8.15	113.0	4.45	103.5	15,000	

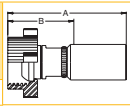
1502 Hammerlug union female — **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HNS6-32-32-SC	4 1/8"-3 ACME	190.0	7.50	94.4	3.80	103.5	15,000	

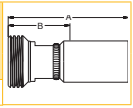
2" – 3,000 psi ***Black Eagle*** Light Hose with inner ColorGard™ 2240N-32V10

Available Subsea Fittings:

1502 Hammerlug union male **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HES6-32-32-FLAT-SUBSEA *	4 1/8“-3 ACME	207.0	8.15	113	4.45	103.5	15,000	

1502 Hammerlug union female **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HNS6-32-32-SUBSEA *	4 1/8“-3 ACME	190.0	7.50	96	3.80	103.5	15,000	

* Material Certificates available on request.

2" – 5,000 psi ***Black Eagle*** Light Hose with inner ColorGard™ 2248N-32V10

CONSTRUCTION

Core tube : PA11 with inner ColorGard™
Pressure reinforcement : 2 layers of high tensile steel wire

Cover : Extra thick TPU sheath
Colour : Black

TEMPERATURE RANGE -40°C up to +100°C / -40°F up to 212°F

MAX. LENGTH 1,000 m
For longer length requests please contact Polyflex Division

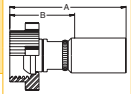
CERTIFICATES DNVGL Type Approval TAD00000CA (see chapter 4)

2248N-32V10

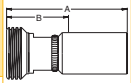
ID		OD		Max. working pressure		Test pressure		Min. burst pressure		Min. bend radius		Weight		Collapse pressure	
mm	inch	mm	inch	MPa	psi	MPa	psi	MPa	psi	mm	inch	kg/m	lbs/ft	MPa	psi
51	2	68.5	2.70	34.5	5,000	51.8	7,500	86.2	12,500	500	19.7	4.4	2.96	3.8	550

Available steel and stainless steel fitting (not suitable for subsea):

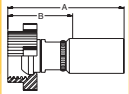
1502 Hammerlug union male — **Material: special steel, zinc plated**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HES6-32-32-FLAT	4 1/8"-3 ACME	207	8.15	113	4.45	103.5	15,000	

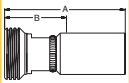
1502 Hammerlug union female — **Material: special steel, zinc plated**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HNS6-32-32	4 1/8"-3 ACME	190	7.50	96	3.80	103.5	15,000	

1502 Hammerlug union male — **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HES6-32-32-FLAT-SC	4 1/8"-3 ACME	207	8.15	113	4.45	103.5	15,000	

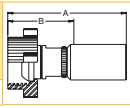
1502 Hammerlug union female — **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HNS6-32-32-SC	4 1/8"-3 ACME	190	7.50	96	3.80	103.5	15,000	

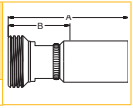
2" – 5,000 psi ***Black Eagle*** Light Hose with inner ColorGard™ 2248N-32V10

Available Subsea Fittings:

1502 Hammerlug union male **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HES6-32-32-FLAT-SUBSEA *	4 1/8“-3 ACME	207	8.15	113	4.45	103.5	15,000	

1502 Hammerlug union female **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HNS6-32-32-SUBSEA *	4 1/8“-3 ACME	190	7.50	96	3.80	103.5	15,000	

* Material Certificates available on request.

2" – 8,000 psi ***Black Eagle*** Light Hose with inner ColorGard™ 2449N-32V10

CONSTRUCTION

Core tube : PA11 with inner ColorGard™
Pressure reinforcement : 4 layers of high tensile steel wire

Cover : Extra thick TPU sheath
Colour : Black

TEMPERATURE RANGE -40°C up to +100°C / -40°F up to 212°F

MAX. LENGTH 1,000 m
For longer length requests please contact Polyflex Division

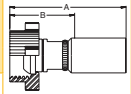
CERTIFICATES DNVGL Type Approval TAD00000CA (see chapter 4)

2449N-32V10

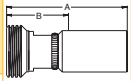
ID		OD		Max. working pressure		Test pressure		Min. burst pressure		Min. bend radius		Weight		Collapse pressure	
mm	inch	mm	inch	MPa	psi	MPa	psi	MPa	psi	mm	inch	kg/m	lbs/ft	MPa	psi
51	2	73.5	2.89	55.2	8,000	82.8	12,000	138.0	20,000	650	25.6	7.65	5.14	4.9	710

Available stainless steel fitting (not suitable for subsea):

1502 Hammerlug union male **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HES8-32-32-FLAT-SC	4 1/8"-3 ACME	207	8.15	113	4.45	103.5	15,000	

1502 Hammerlug union female **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HNS8-32-32-SC	4 1/8"-3 ACME	190	7.50	96	3.80	103.5	15,000	

1 1/4" – 10,000 psi ***Black Eagle*** Hose with ColorGard™ 2440N-20V80

CONSTRUCTION

Core tube : PA11
Pressure reinforcement : 4 layers of high tensile steel wire

Cover : Extra thick dual layer TPU sheath
Colour : ColorGard™ – red inner sheath and black outer sheath

TEMPERATURE RANGE -40°C up to +100°C / -40°F up to 212°F

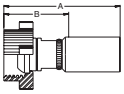
MAX. LENGTH 1,500 m
For longer length requests please contact Polyflex Division

CERTIFICATES DNVGL Type Approval TAD00000CA (see chapter 4)

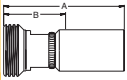
2440N-20V80

ID		OD		Max. working pressure		Test pressure		Min. burst pressure		Min. bend radius		Weight		Collapse pressure	
mm	inch	mm	inch	MPa	psi	MPa	psi	MPa	psi	mm	inch	kg/m	lbs/ft	MPa	psi
32.2	1 1/4	55.5	2.19	69.0	10,000	103.5	15,000	172.5	25,000	400	15.8	3.8	2.55	6.0	870

1502 Hammerlug union male **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HELX-32-20C4462-FLAT	4 1/8"-3 ACME	191	7.52	117	4.59	103.5	15,000	

1502 Hammerlug union female **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HNLX-32-20C4462	4 1/8"-3 ACME	176	6.92	101	3.98	103.5	15,000	

1 1/2" – 10,000 psi ***Black Eagle*** Hose with ColorGard™ 2640N-24V80

CONSTRUCTION

Core tube : PA11
Pressure reinforcement : 6 layers of high tensile steel wire

Cover : Extra thick dual layer TPU sheath
Colour : ColorGard™ – red inner sheath and black outer sheath

TEMPERATURE RANGE -40°C up to +70°C / -40°F up to 158°F

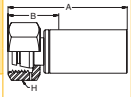
MAX. LENGTH 1,000 m
For longer length requests please contact Polyflex Division

CERTIFICATES DNVGL Type Approval TAD00000CA (see chapter 4)

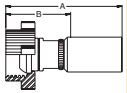
2640N-24V80

ID		OD		Max. working pressure		Test pressure		Min. burst pressure		Min. bend radius		Weight		Collapse pressure	
mm	inch	mm	inch	MPa	psi	MPa	psi	MPa	psi	mm	inch	kg/m	lbs/ft	MPa	psi
38.0	1 1/2	70.5	2.78	69.0	10,000	103.5	15,000	230.0	33,350	500	19.7	7.20	4.84	6.5	950

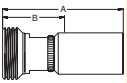
Metric swivel fitting with O-ring **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		H	Working pressure		
		mm	inch	mm	inch	mm	MPa	psi	
1C95X-38-24COSK-TC	M52 x 2	143	5.63	50	1.97	65	103.5	15,000	

1502 Hammerlug union male **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HE5X-32-24C4462-FLATTC	4 1/8"-3 ACME	232	9.13	108	4.25	103.5	15,000	

1502 Hammerlug union female **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HN5X-32-24C4462-TC	4 1/8"-3 ACME	245	9.65	108	4.25	103.5	15,000	

1 1/2" – 15,000 psi ***Black Eagle*** Hose with ColorGard™ 2640N-24V80-15K

CONSTRUCTION

Core tube : PA11
Pressure reinforcement : 6 layers of high tensile steel wire

Cover : Extra thick dual layer TPU sheath
Colour : ColorGard™ – red inner sheath and black outer sheath

TEMPERATURE RANGE -40°C up to +70°C / -40°F up to 158°F

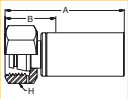
MAX. LENGTH 1,000 m
For longer length requests please contact Polyflex Division

CERTIFICATES DNVGL Type Approval TAD00000CA (see chapter 4)

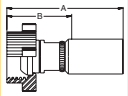
2640N-24V80-15K

ID		OD		Max. working pressure		Test pressure		Min. burst pressure		Min. bend radius		Weight		Collapse pressure	
mm	inch	mm	inch	MPa	psi	MPa	psi	MPa	psi	mm	inch	kg/m	lbs/ft	MPa	psi
38.0	1 1/2	66.0	2.60	103.5	15,000	155.3	22,500	233.0	33,750	500	19.7	6.50	4.37	6.6	957

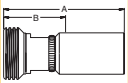
Metric swivel fitting with O-ring **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Wrench size H	Working pressure		
		mm	inch	mm	inch	mm	MPa	psi	
1C95X-38-24COSK-KOP2	M52 x 2	143	5.63	50	1.97	65	103.5	15,000	

1502 Hammerlug union male **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HE5X-32-24C4462-KOP2	4 1/8"-3 ACME	232	9.13	108	4.25	103.5	15,000	

1502 Hammerlug union female **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HN5X-32-24C4462-KOP2	4 1/8"-3 ACME	245	9.65	108	4.25	103.5	15,000	

2" – 5,000 psi ***Black Eagle*** Hose with ColorGard™ 2448N-32V80

CONSTRUCTION

Core tube : PA11
Pressure reinforcement : 4 layers of high tensile steel wire

Cover : Extra thick dual layer TPU sheath
Colour : ColorGard™ – red inner sheath and black outer sheath

TEMPERATURE RANGE -40°C up to +70°C / -40°F up to 158°F

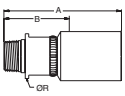
MAX. LENGTH 1,400 m
For longer length requests please contact Polyflex Division

CERTIFICATES DNVGL Type Approval TAD00000CA (see chapter 4)

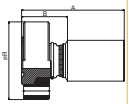
2448N-32V80

ID		OD		Max. working pressure		Test pressure		Min. burst pressure		Min. bend radius		Weight		Collapse pressure	
mm	inch	mm	inch	MPa	psi	MPa	psi	MPa	psi	mm	inch	kg/m	lbs/ft	MPa	psi
50.5	2	80.5	3.17	34.5	5,000	51.8	7,500	138.0	20,000	500	19.7	8.50	5.71	4.9	710

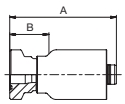
NPT Male fitting **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		ØR		Working pressure		
		mm	inch	mm	inch	mm	inch	MPa	psi	
101BL-32-32	2" NPT	275	10.8	129	5.08	83	3.27	34.5	5,000	
6015X-32-32-TC	2" NPT	244	9.61	107	4.22	82.5	3.25	34.5	5,000	

API flange, swivel **Material: Special Steel and Stainless Steel Materials**

Part no.	API size	A		B		ØR		Seal	Working pressure		
		mm	inch	mm	inch	mm	inch		MPa	psi	
68K5X-29-32-API17DSV	1-13/16" 10000psi	250	9.84	113	4.46	185	7.28	BX151	69.0	10,000	
18KBL-33-32-API17DSV-10K	2-1/16" 10000psi	275	10.83	129	5.08	210	8.27	BX152	69.0	10,000	

API Hub **Material: Special Steel and Stainless Steel Materials**

Part no.	API size	A		B		Seal	Working pressure		
		mm	inch	mm	inch		MPa	psi	
1HBBL-29-32-10K	1 13/16" 10000 psi	275	10.8	129	5.08	BX151	69.0	10,000	
1HBBL-33-32-10K-L*	2-1/16" 10000psi	280	11.0	134	5.28	BX152	69.0	10,000	

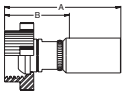
* with Inconel inlay

2" – 5,000 psi ***Black Eagle*** Hose with ColorGard™ 2448N-32V80

602 Hammerlug union male

Material: Special Steel and Stainless Steel Materials

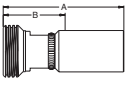
Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
6HE5X-32-32-602APITC	3 13/16" - 3 ACME	280	11.0	141	5.55	34.5	5,000



602 Hammerlug union female

Material: Special Steel and Stainless Steel Materials

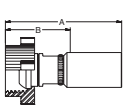
Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
6HN5X-32-32-602TC	3 13/16" - 3 ACME	245	9.65	106	4.17	34.5	5,000



1502 Hammerlug union male

Material: Special Steel and Stainless Steel Materials

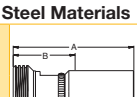
Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HEBL-32-32-FLAT	4 1/8"-3 ACME	278	10.9	132	5,21	103.5	15,000
6HE5X-32-32-FLATTC	4 1/8"-3 ACME	292	11.5	155	6.10	103.5	15,000



1502 Hammerlug union female

Material: Special Steel and Stainless Steel Materials

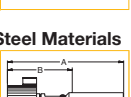
Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HNBL-32-32	4 1/8"-3 ACME	263	10.4	117	4.61	103.5	15,000
6HN5X-32-32-TC	4 1/8"-3 ACME	243	9.57	106	4.17	103.5	15,000



1502 Hammerlug union male, segmented

Material: Special Steel and Stainless Steel Materials

Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HEBL-32-32-SEG	4 1/8" - 3 ACME	278	10.9	132	5.21	103.5	15,000



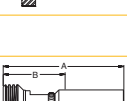
2202 Hammerlug union male

Material: Special Steel and Stainless Steel Materials

Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HEBL-32-32-FLAT-2202	3 5/8-5 ACME – 2G	290	11.4	144	5.67	103.5	15,000

2202 Hammerlug union female

Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HNBL-32-32-2202	3 5/8-5 ACME – 2G	265	10.4	119	4.68	103.5	15,000



2" – 10,000 psi ***Black Eagle*** Hose with ColorGard™ 2580N-32V80

CONSTRUCTION

Core tube : PA11
Pressure reinforcement : 6 layers of high tensile steel wire

Cover : Extra thick dual layer TPU sheath
Colour : ColorGard™ – red inner sheath and black outer sheath

TEMPERATURE RANGE -40°C up to +70°C / -40°F up to 158°F

MAX. LENGTH 1,400 m
For longer length requests please contact Polyflex Division

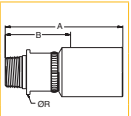
CERTIFICATES DNVGL Type Approval TAD00000CA (see chapter 4)
ABS Product Design Assessment (PDA) Certificate 13-HS1036876-PDA

2580N-32V80

ID		OD		Max. working pressure		Test pressure		Min. burst pressure		Min. bend radius		Weight		Collapse pressure	
mm	inch	mm	inch	MPa	psi	MPa	psi	MPa	psi	mm	inch	kg/m	lbs/ft	MPa	psi
50.5	2	84.5	3.33	69.0	10,000	103.5	15,000	172.5	25,000	800	31.5	9.40	6.32	5.7	825

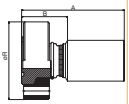
NPT Male fitting

Material: Special Steel and Stainless Steel Materials

Part no.	Thread size	A		B		ØR		Working pressure		
		mm	inch	mm	inch	mm	inch	MPa	psi	
101BL-32-32	2" NPT	275	10.8	129	5.08	83	3.27	34.5	5,000	
6015X-32-32	2" NPT	244	9.61	107	4.22	82.5	3.25	34.5	5,000	

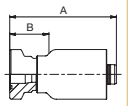
API flange, swivel

Material: Special Steel and Stainless Steel Materials

Part no.	API size	A		B		ØR		Seal	Working pressure		
		mm	inch	mm	inch	mm	inch		MPa	psi	
68K5X-29-32-API17DSV	1-13/16" 10000psi	250.0	9.84	113	4.46	185	7.28	BX151	69.0	10,000	
18KBL-33-32-API17DSV-10K	2-1/16" 10000psi	275.0	10.83	129	5.08	210	8.27	BX152	69.0	10,000	

API Hub

Material: Special Steel and Stainless Steel Materials

Part no.	API size	A		B		Seal	Working pressure		
		mm	inch	mm	inch		MPa	psi	
1HBBL-29-32-10K	1 13/16" 10000 psi	275	10.8	129	5.08	BX151	69.0	10,000	
1HBBL-33-32-10K-L*	2-1/16" 10000psi	280	11.0	134	5.28	BX152	69.0	10,000	

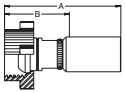
* with Inconel inlay

2" – 10,000 psi ***Black Eagle*** Hose with ColorGard™ 2580N-32V80

1502 Hammerlug union male

Material: Special Steel and Stainless Steel Materials

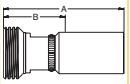
Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HEBL-32-32-FLAT	4 1/8"-3 ACME	278	10.9	132	5,21	103.5	15,000
6HE5X-32-32-FLATTC	4 1/8"-3 ACME	292	11.5	155	6.10	103.5	15,000



1502 Hammerlug union female

Material: Special Steel and Stainless Steel Materials

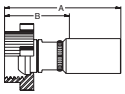
Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HNBL-32-32	4 1/8"-3 ACME	263	10.4	117	4.61	103.5	15,000
6HN5X-32-32-TC	4 1/8"-3 ACME	243	9.57	106	4.17	103.5	15,000



1502 Hammerlug union male, segmented

Material: Special Steel and Stainless Steel Materials

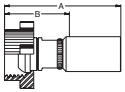
Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HEBL-32-32-SEG	4 1/8" - 3 ACME	278	10.9	132	5.21	103.5	15,000



2202 Hammerlug union male

Material: Special Steel and Stainless Steel Materials

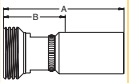
Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HEBL-32-32-FLAT-2202	3 5/8-5 ACME – 2G	290	11.4	144	5.67	103.5	15,000



2202 Hammerlug union female

Material: Special Steel and Stainless Steel Materials

Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HNBL-32-32-2202	3 5/8-5 ACME – 2G	265	10.4	119	4.68	103.5	15,000



2" – 15,000 psi ***Black Eagle*** Hose with ColorGard™ 2648N-32V80

CONSTRUCTION

Core tube : PA11
Pressure reinforcement : 6 layers of high tensile steel wire

Cover : Extra thick dual layer TPU sheath
Colour : ColorGard™ – red inner sheath and black outer sheath

TEMPERATURE RANGE -40°C up to +70°C / -40°F up to 158°F

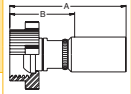
MAX. LENGTH 1,250 m
For longer length requests please contact Polyflex Division

CERTIFICATES DNVGL Type Approval TAD00000CA (see chapter 4)

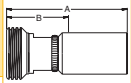
2648N-32V80

ID		OD		Max. working pressure		Test pressure		Min. burst pressure		Min. bend radius		Weight		Collapse pressure	
mm	inch	mm	inch	MPa	psi	MPa	psi	MPa	psi	mm	inch	kg/m	lbs/ft	MPa	psi
50.5	2	86.0	3.39	103.5	15,000	155.3	22,500	233.0	33,750	800	31.0	12.1	8.13	6.0	870

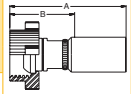
1502 Hammerlug union male **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HECX-32-32-FLAT	4 1/8"-3 ACME	298	11.7	132	5.20	103.5	15,000	

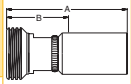
1502 Hammerlug union female **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HNCX-32-32	4 1/8"-3 ACME	284	11.2	118	4.65	103.5	15,000	

2202 Hammerlug union male **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HECX-32-32-FLAT-2202	3 5/8-5 ACME – 2G	290	11.4	124	4.88	103.5	15,000	

2202 Hammerlug union female **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HNCX-32-32-2202	3 5/8-5 ACME – 2G	265	10.4	99	3.90	103.5	15,000	

3" – 5,000 psi ***Black Eagle*** Hose with ColorGard™ 2240N-48V80

CONSTRUCTION

Core tube : PA11
Pressure reinforcement : 2 layers of high tensile steel wire

Cover : Extra thick dual layer TPU sheath
Colour : ColorGard™ – red inner sheath and black outer sheath

TEMPERATURE RANGE -40°C up to +70°C / -40°F up to 158°F

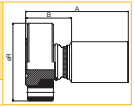
MAX. LENGTH 350 m
For longer length requests please contact Polyflex Division

CERTIFICATES DNVGL Type Approval TAD00000CA (see chapter 4)

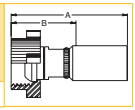
2240N-48V80

ID		OD		Max. working pressure		Test pressure		Min. burst pressure		Min. bend radius		Weight		Collapse pressure	
mm	inch	mm	inch	MPa	psi	MPa	psi	MPa	psi	mm	inch	kg/m	lbs/ft	MPa	psi
75.0	3	114.0	4.49	34.5	5,000	51.8	7,500	86.2	12,500	1000	40.0	11.50	7.73	2.0	290

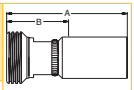
API flange, swivel **Material: Special Steel and Stainless Steel Materials**

Part no.	API size	A		B		ØR		Seal	Working pressure		
		mm	inch	mm	inch	mm	inch		MPa	psi	
18KTX-65-48-API17DSV10KL	4 1/16" 10,000 psi	427	16.8	261	10.3	315	12.4	BX155	69	10000	

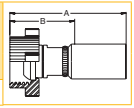
602 Hammerlug union male **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HETX-48-48-FLAT-602	5 3/8" - 3 ACME	372	14.6	206	8.11	34.5	5,000	

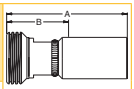
602 Hammerlug union female **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HNTX-48-48-602	5 3/8" - 3 ACME	350	13.8	184	7.25	34.5	5,000	

1502 Hammerlug union male **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HETX-48-48-FLAT	5 3/8" - 3 1/2 - ACME	378	14.9	212	8.35	103.5	15,000	

1502 Hammerlug union female **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HNTX-48-48	5 3/8" - 3 1/2 - ACME	350	13.8	184	7.25	103.5	15,000	

3" – 10,000 psi ***Black Eagle*** Hose with ColorGard™ 2440N-48V80

CONSTRUCTION

Core tube : PA11
Pressure reinforcement : 4 layers of high tensile steel wire

Cover : Extra thick dual layer TPU sheath
Colour : ColorGard™ – red inner sheath and black outer sheath

TEMPERATURE RANGE -40°C up to +70°C / -40°F up to 158°F

MAX. LENGTH 300 m
For longer length requests please contact Polyflex Division

CERTIFICATES DNVGL Type Approval TAD00000CA (see chapter 4)

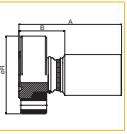
2440N-48V80

ID		OD		Max. working pressure		Test pressure		Min. burst pressure		Min. bend radius		Weight		Collapse pressure	
mm	inch	mm	inch	MPa	psi	MPa	psi	MPa	psi	mm	inch	kg/m	lbs/ft	MPa	psi
75.0	3	122.0	4.80	69.0	10,000	103.5	15,000	138.0	20,000	1100	43.3	18.70	12.57	6.6	957

API flange, swivel

Material: Special Steel and Stainless Steel Materials

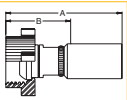
Part no.	API size	A		B		ØR		Seal	Working pressure	
		mm	inch	mm	inch	mm	inch		MPa	psi
18KLX-49-48-API17DSV-10K	3 1/16" 10,000 psi	455	17.9	244	9.61	270	10.6	BX154	69.0	10,000
18KLX-65-48-API17DSV-10K	4 1/16" 10,000 psi	482	19.0	246	9.68	315	12.4	BX155	69.0	10,000



1502 Hammerlug union male

Material: Special Steel and Stainless Steel Materials

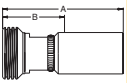
Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HELX-48-48-FLAT	5 3/8 - 3 1/2 ACME	395	15.6	184	7.24	103.5	15,000



1502 Hammerlug union female

Material: Special Steel and Stainless Steel Materials

Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HNLX-48-48	5 3/8 - 3 1/2 ACME	405	15.9	194	7.64	103.5	15,000



3" – 15,000 psi ***Black Eagle*** Hose with ColorGard™ 2640N-48V80

CONSTRUCTION

Core tube : PA11
Pressure reinforcement : 6 layers of high tensile steel wire

Cover : Extra thick dual layer TPU sheath
Colour : ColorGard™ – red inner sheath and black outer sheath

TEMPERATURE RANGE -40°C up to +70°C / -40°F up to 158°F

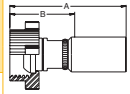
MAX. LENGTH 250 m
For longer length requests please contact Polyflex Division

CERTIFICATES DNVGL Type Approval TAD00000CA (see chapter 4)

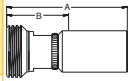
2640N-48V80

ID		OD		Max. working pressure		Test pressure		Min. burst pressure		Min. bend radius		Weight		Collapse pressure	
mm	inch	mm	inch	MPa	psi	MPa	psi	MPa	psi	mm	inch	kg/m	lbs/ft	MPa	psi
75.0	3	130.0	5.12	103.5	15,000	155.3	22,500	233.0	33,750	1200	47.2	27.50	18.48	8.0	1,160

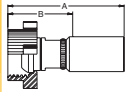
1502 Hammerlug union male **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HE5X-48-48-FLAT	5 3/8 - 3 1/2 ACME	395	15.5	184	7.24	103.5	15,000	

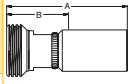
1502 Hammerlug union female **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HN5X-48-48	5 3/8 - 3 1/2 ACME	405	15.9	194	7.64	103.5	15,000	

2202 Hammerlug union male **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HE5X-48-48-FLAT-2202	6 11/16 - 5 ACME	470	18.5	250	9.84	103.5	15,000	

2202 Hammerlug union female **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HN5X-48-48-2202	6 11/16 - 5 ACME	430	16.9	210	8.27	103.5	15,000	

1 1/2" – 10,000 psi ***Golden Eagle*** Hose with ColorGard™ 2640M-24V88

CONSTRUCTION

Core tube : Fluorpolymer based inner core
Pressure reinforcement : 6 layers of high tensile steel wire

Cover : Extra thick dual layer TPU sheath
Colour : ColorGard™ – red inner sheath and golden outer sheath

TEMPERATURE RANGE

-40°C up to +70°C / -40°F up to 158°F,
for higher temperature requirements please contact Polyflex Division

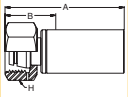
MAX. LENGTH

600 m
For longer length requests please contact Polyflex Division

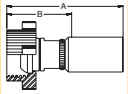
2640M-24V88

ID		OD		Max. working pressure		Test pressure		Min. burst pressure		Min. bend radius		Weight		Collapse pressure	
mm	inch	mm	inch	MPa	psi	MPa	psi	MPa	psi	mm	inch	kg/m	lbs/ft	MPa	psi
38.0	1 1/2	70.5	2.78	69.0	10,000	103.5	15,000	230.0	33,350	500	19.7	7.20	4.84	6.5	950

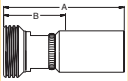
Metric swivel fitting with O-ring **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		H	Working pressure		
		mm	inch	mm	inch	mm	MPa	psi	
1C95X-38-24COSK-TC	M52 x 2	143	5.63	50	1.97	65	103.5	15,000	

1502 Hammerlug union male **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HE5X-32-24C4462-FLATTC	4 1/8"-3 ACME	232	9.1	108	4.25	103.5	15,000	

1502 Hammerlug union female **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure		
		mm	inch	mm	inch	MPa	psi	
1HN5X-32-24C4462-TC	4 1/8"-3 ACME	245	9.65	108	4.25	103.5	15,000	

2" – 5,000 psi ***Golden Eagle*** Hose with ColorGard™ 2448M-32V88

CONSTRUCTION

Core tube : Fluorpolymer based inner core
Pressure reinforcement : 4 layers of high tensile steel wire

Cover : Extra thick dual layer TPU sheath
Colour : ColorGard™ – red inner sheath and golden outer sheath

TEMPERATURE RANGE

-40°C up to +70°C / -40°F up to 158°F,
for higher temperature requirements please contact Polyflex Division

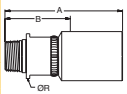
MAX. LENGTH

600 m
For longer length requests please contact Polyflex Division

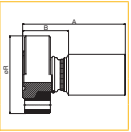
2448M-32V88

ID		OD		Max. working pressure		Test pressure		Min. burst pressure		Min. bend radius		Weight		Collapse pressure	
mm	inch	mm	inch	MPa	psi	MPa	psi	MPa	psi	mm	inch	kg/m	lbs/ft	MPa	psi
50.5	2	82.0	3.23	34.5	5,000	51.8	7,500	138.0	20,000	500	19.7	8.50	5.71	4.9	710

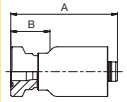
NPT Male fitting **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		ØR		Working pressure		
		mm	inch	mm	inch	mm	inch	MPa	psi	
101BL-32-32	2" NPT	275	10.8	129	5.08	83	3.27	34.5	5,000	
6015X-32-32-TC	2" NPT	244	9.61	107	4.22	82.5	3.25	34.5	5,000	

API flange, swivel **Material: Special Steel and Stainless Steel Materials**

Part no.	API size	A		B		ØR		Seal	Working pressure		
		mm	inch	mm	inch	mm	inch		MPa	psi	
68K5X-29-32-API17DSV	1-13/16" 10000psi	250	9.84	113	4.46	185	7.28	BX151	69.0	10,000	
18KBL-33-32-API17DSV-10K	2-1/16" 10000psi	275	10.83	129	5.08	210	8.27	BX152	69.0	10,000	

API Hub **Material: Special Steel and Stainless Steel Materials**

Part no.	API size	A		B		Seal	Working pressure		
		mm	inch	mm	inch		MPa	psi	
1HBBL-29-32-10K	1 13/16" 10000 psi	275	10.8	129	5.08	BX151	69.0	10,000	
1HBBL-33-32-10K-L*	2-1/16" 10000psi	280	11.0	134	5.28	BX152	69.0	10,000	

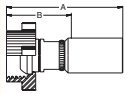
* with Inconel inlay

2" – 5,000 psi ***Golden Eagle*** Hose with ColorGard™ 2448M-32V88

602 Hammerlug union male

Material: Special Steel and Stainless Steel Materials

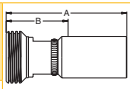
Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
6HE5X-32-32-602APITC	3 13/16" - 3 ACME	280	11.0	141	5.55	34.5	5,000



602 Hammerlug union female

Material: Special Steel and Stainless Steel Materials

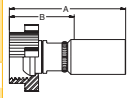
Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
6HN5X-32-32-602TC	3 13/16" - 3 ACME	245	9.65	106	4.17	34.5	5,000



1502 Hammerlug union male

Material: Special Steel and Stainless Steel Materials

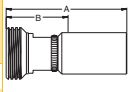
Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HEBL-32-32-FLAT	4 1/8"-3 ACME	278	10.9	132	5,21	103.5	15,000
6HE5X-32-32-FLATTC	4 1/8"-3 ACME	292	11.5	155	6.10	103.5	15,000



1502 Hammerlug union female

Material: Special Steel and Stainless Steel Materials

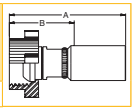
Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HNBL-32-32	4 1/8"-3 ACME	263	10.4	117	4.61	103.5	15,000
6HN5X-32-32-TC	4 1/8"-3 ACME	243	9.57	106	4.17	103.5	15,000



1502 Hammerlug union male, segmented

Material: Special Steel and Stainless Steel Materials

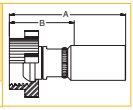
Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HEBL-32-32-SEG	4 1/8" - 3 ACME	278	10.9	132	5.21	103.5	15,000



2202 Hammerlug union male

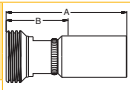
Material: Special Steel and Stainless Steel Materials

Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HEBL-32-32-FLAT-2202	3 5/8-5 ACME – 2G	290	11.4	144	5.67	103.5	15,000



2202 Hammerlug union female

Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HNBL-32-32-2202	3 5/8-5 ACME – 2G	265	10.4	119	4.68	103.5	15,000



2" – 10,000 psi ***Golden Eagle*** Hose with ColorGard™ 2580M-32V88

CONSTRUCTION

Core tube : Fluorpolymer based inner core
Pressure reinforcement : 6 layers of high tensile steel wire

Cover : Extra thick dual layer TPU sheath
Colour : ColorGard™ – red inner sheath and golden outer sheath

TEMPERATURE RANGE

-40°C up to +70°C / -40°F up to 158°F,
for higher temperature requirements please contact Polyflex Division

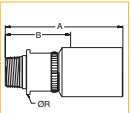
MAX. LENGTH

600 m
For longer length requests please contact Polyflex Division

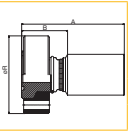
2580M-32V88

ID		OD		Max. working pressure		Test pressure		Min. burst pressure		Min. bend radius		Weight		Collapse pressure	
mm	inch	mm	inch	MPa	psi	MPa	psi	MPa	psi	mm	inch	kg/m	lbs/ft	MPa	psi
50.5	2	84.5	3.33	69.0	10,000	107.5	15,000	172.5	25,000	800	31.5	9.40	6.32	5.7	825

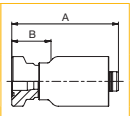
NPT Male fitting **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		ØR		Working pressure		
		mm	inch	mm	inch	mm	inch	MPa	psi	
101BL-32-32	2" NPT	275	10.8	129	5.08	83	3.27	34.5	5,000	
6015X-32-32	2" NPT	244	9.61	107	4.22	82.5	3.25	34.5	5,000	

API flange, swivel **Material: Special Steel and Stainless Steel Materials**

Part no.	API size	A		B		ØR		Seal	Working pressure		
		mm	inch	mm	inch	mm	inch		MPa	psi	
68K5X-29-32-API17DSV	1-13/16" 10000psi	250.0	9.84	113	4.46	185	7.28	BX151	69.0	10,000	
18KBL-33-32-API17DSV-10K	2-1/16" 10000psi	275.0	10.83	129	5.08	210	8.27	BX152	69.0	10,000	

API Hub **Material: Special Steel and Stainless Steel Materials**

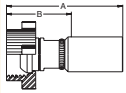
Part no.	API size	A		B		Seal	Working pressure		
		mm	inch	mm	inch		MPa	psi	
1HBBL-29-32-10K	1 13/16" 10000 psi	275	10.8	129	5.08	BX151	69.0	10,000	
1HBBL-33-32-10K-L*	2-1/16" 10000psi	280	11.0	134	5.28	BX152	69.0	10,000	

* with Inconel inlay

2" – 10,000 psi ***Golden Eagle*** Hose with ColorGard™ 2580M-32V88

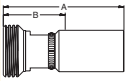
1502 Hammerlug union male — **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HEBL-32-32-FLAT	4 1/8"-3 ACME	278	10.9	132	5,21	103.5	15,000
6HE5X-32-32-FLATTC	4 1/8"-3 ACME	292	11.5	155	6.10	103.5	15,000



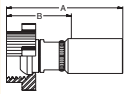
1502 Hammerlug union female — **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HNBL-32-32	4 1/8"-3 ACME	263	10.4	117	4.61	103.5	15,000
6HN5X-32-32-TC	4 1/8"-3 ACME	243	9.57	106	4.17	103.5	15,000



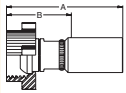
1502 Hammerlug union male, segmented — **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HEBL-32-32-SEG	4 1/8" - 3 ACME	278	10.9	132	5.21	103.5	15,000



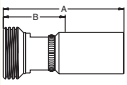
2202 Hammerlug union male — **Material: Special Steel and Stainless Steel Materials**

Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HEBL-32-32-FLAT-2202	3 5/8-5 ACME – 2G	290	11.4	144	5.67	103.5	15,000



2202 Hammerlug union female — **Material: Special Steel and Stainless Steel Materials**

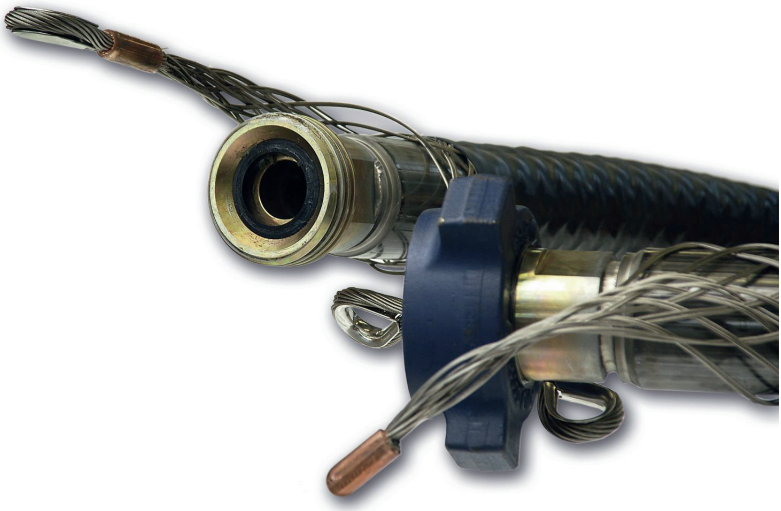
Part no.	Thread size	A		B		Working pressure	
		mm	inch	mm	inch	MPa	psi
1HNBL-32-32-2202	3 5/8-5 ACME – 2G	265	10.4	119	4.68	103.5	15,000



3.5 Acessoires

Containment grips

#	Description
HS-20	Containment grip DN32, 50-60
HS-28	Containment grip DN46, 60-70
HS-32	Containment grip DN50, 90-110



Chapter 4

Technical information

4.1 DNV Type Approval TAD00000CA acc. to API 7K

DNV·GL

Certificate No:
TAD00000CA

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Mud and Cementing Equipment

with type designation(s)
1.25" to 3" Black Eagle Flexible Hoses for Cementing and Chemical Injection

Issued to
Parker Hannifin Manufacturing Germany GmbH & Co. KG - Polyflex Division Europe
LAMPERTHEIM, Germany

is found to comply with
DNVGL-OS-E101 – Drilling plant, Edition July 2015

Application :

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL, with exception of vessels where full compliance with API Specification 7K is mandatory.
Product(s) covered in this certificate are: cementing flexible hoses and chemical injection flexible hoses.

This Certificate is valid until **2021-04-30**.

Issued at **Høvik** on **2016-05-01**

for **DNV GL**

DNV GL local station: **Augsburg**

Approval Engineer: **Sinisa Sedlan**

Marianne Spæren Marveng
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.

Form code: TA 1411a Revision: 2015-05 www.dnvgl.com Page 1 of 4

4.2 ABS Product Design Assessment for 2580N-32V80

CERTIFICATE NUMBER
13-HS1036876-PDA

DATE
18 June 2013

ABS TECHNICAL OFFICE
Houston OED - Equipment

CERTIFICATE OF DESIGN ASSESSMENT

This is to Certify that a representative of this Bureau did, at the request of

PARKER HANNIFIN CORPORATION-ENERGY PRODUCTS DIVISION - STAFFORD

assess design plans and data for the below listed product. This assessment is a representation by the Bureau as to the degree of compliance the design exhibits with applicable sections of the Rules. This assessment does not waive unit certification or classification procedures required by ABS Rules for products to be installed in ABS classed vessels or facilities. This certificate, by itself, does not reflect that the product is Type Approved. The scope and limitations of this assessment are detailed on the pages attached to this certificate.

PRODUCT: **Hose, Non Metallic, High Pressure**

MODEL: **2580N-32V80**

This Product Design Assessment (PDA) Certificate 13-HS1036876-PDA, dated 18/Jun/2013 remains valid until 17/Jun/2018 or until the Rules or specifications used in the assessment are revised (whichever occurs first).

This PDA is intended for a product to be installed on an ABS classed vessel, MODU or facility which is in existence or under contract for construction on the date of the ABS Rules or specifications used to evaluate the Product.

Use of the Product on an ABS classed vessel, MODU or facility which is contracted after the validity date of the ABS Rules and specifications used to evaluate the Product, will require re-evaluation of the PDA.

Use of the Product for non ABS classed vessels, MODUs or facilities is to be to an agreement between the manufacturer and intended client.

AMERICAN BUREAU OF SHIPPING

Tim Kimble
Engineer

AB258(0110)

4.3 PFDE-ES28 - Handling, maintenance, inspection and repair

ISSUED: G. Ford 26. January 2010	**PARKER ENGINEERING MANUAL**	SPEC: PFDE-ES28
REVISED / CHECKED M. Levin 17. Apr. 2018	**Parker Hannifin Corporation Polyflex Division Europe**	REVISION R
SUBJECT: **Instructions for handling, maintenance, inspection and repair of Parker Polyflex BLACK EAGLE hoses and assemblies**		PAGE: 1 of 41

Contents

ISSUED: G. Ford 26. January 2010	**PARKER ENGINEERING MANUAL**	SPEC: PFDE-ES28
REVISED / CHECKED M. Levin 17. Apr. 2018	**Parker Hannifin Corporation Polyflex Division Europe**	REVISION R
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ISSUED: G. Ford 26. January 2010	**PARKER ENGINEERING MANUAL**	SPEC: PFDE-ES28
REVISED / CHECKED M. Levin 17. Apr. 2018	**Parker Hannifin Corporation Polyflex Division Europe**	REVISION R
SUBJECT: **Instructions for handling, maintenance, inspection and repair of Parker Polyflex BLACK EAGLE hoses and assemblies**		PAGE: 3 of 41

1 Scope

This engineering standard is focused mainly on larger bore (1”-3”) long length Parker Polyflex multispiral wire reinforced hoses used in well service operations. It is also relevant for shorter length hose assembly applications such as chemical injection, stimulation, cementing, flexible and testing lines. It provides information on recommended practices for handling, maintenance, inspection, and repair of hose assemblies.

Deployed as single line hoses or used in bundles, Parker Polyflex multispiral wire reinforced hoses are available in sizes from 3/16” to 3” inside diameter and working pressures up to 1035 bar / 15000 psi and continuous lengths greater than 3000 m depending on size.

Hose can be self-supporting, clamped, supported by a guide wire or strengthened with an additional tensile reinforcement.

Parker Polyflex have certified several specialized testing facilities and their personnel to assemble, inspect, test and repair hose assemblies. Hose management is an essential part of the service they provide.

SAE J1273, ISO 17165-2, API RP 17B and ISO 13628 are excellent documents providing general guidelines for selection, routing, fabrication, installation, replacement, maintenance, and storage of hose and hose assemblies. Together with Parker Polyflex field experience, they provide the basis for the recommendations included in this engineering standard.

2 Hose Features

Parker Polyflex Oil & Gas multispiral wire reinforced hoses have been used for over 30 years in both onshore and offshore applications. They are proven to be tough, easy to handle, lightweight compared with alternatives and offer excellent chemical resistance, integral external collapse, ozone and microbiological resistance.

In extreme, abrasive applications, Polyflex offers an additional extra thick ColorGard™ sheath incorporating a dual colour “early warning” safety feature.

2.1 Design life

Parker Polyflex large bore hoses are designed for prolonged service life. The prerequisite for this design life is that the hoses are used within the operating limits, stated in the hose specification sheets. These limits include, but are not limited to working pressure, number of pressure cycles, temperature range and bending radius.

In order to ensure a long service life, Parker Polyflex incorporates a combination of raw material suppliers testing and data, fatigue testing, accelerated and specialized testing into the design of the hoses.

Obviously, due to many other factors, affecting the service life, it is not possible to predict or guarantee service life of each individual hose assembly.

These factors may include, but are not limited to mechanical loads (bending, torsion, tensile loads), frequent changes of temperature within the specified range, improper handling and storage, chemical attack, abrasive fluids, hose damage etc.

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REVISED / CHECKED M. Levin 17. Apr. 2018	**Parker Hannifin Corporation Polyflex Division Europe**	REVISION R
SUBJECT: **Instructions for handling, maintenance, inspection and repair of Parker Polyflex BLACK EAGLE hoses and assemblies**		PAGE: 4 of 41

3 Storage

Hoses and hose assemblies should be stored, wherever possible, empty and protected from the elements in a stress-free condition either straight, in a coil, or on a drum. The inside diameter of the coil or drum should not be less than two times the minimum bend radius. If a hose assembly has been used with chemicals, it shall be flushed with water before putting it to storage (see also P.5.4).

Example: hose with minimum bend radius 800 mm; minimum size of drum core/belly should be 2 × 800 mm = 1.6 m.

The fittings should be capped to prevent ingress of dirt or other contamination and any exposed threads protected from damage.

Storage of hoses and hose assemblies should take into account potential exposure to corrosive liquids, rodents, insects, UV light and high temperatures. Storage temperatures should be in the range of hose operating temperatures.

4 Handling

4.1 Personnel

Only trained personnel shall handle and connect hose assemblies.

Incorrect handling will seriously reduce the lifetime of the hose and could cause dramatic failure. The use of wire rope or chains directly against the outer cover should be avoided, and the routing of the assembly should ensure the hose is never bent below its minimum bend radius or twisted. Special attention should be paid to the area at the back of the fitting.

4.2 Spooling and reeling

When reeling long length hose onto a drum it is essential to minimize the tension on the hose. Proof testing of a “stretched” hose while on the drum can cause premature failure of the hose or damage to the drum.

When operating from a vessel it is recommended that the hose is pressurized during the subsea deployment and retrieving operation. This recommendation is based on the fact that during these operations the hose is always subjected to tensile force, at least due to its own weight. Tensile forces will result in hose elongation and possible deformation.

This is significantly reduced by pressurizing the hose, especially important if it is planned to proof test the hose assembly while coiled on a drum or winch. Deployment and retrieving pressures up to 200 bar had been found to be sufficient but this depends on the hose type and local safety regulations. For recommendations of pressure / load values see Appendix 2.

When re-spooling a long length assembly, the pay-off and take-up drums should be inline and a minimum of 10m apart. Depending on how the hose was delivered or re-spooled, the hose shall be spooled from either the top of the pay-off drum onto the top of the take-up drum or from bottom to bottom. See Fig. 1 and Fig. 2. These recommendations minimize the possibility of inducing twist into the hose.

When re-spooling a new hose that has a polyurethane cover, it is recommended to lubricate the hose cover with soapy water or other suitable lubricant so the hose will traverse more easily and position itself correctly onto the take-up drum/winch. See Fig. 1.

It is also recommended, when deploying the hose though a moon pool or over the side of a vessel, to align the hose routing in the same manner. See Fig. 2.

Note:
When first supplied, the layline printed on the hose is normally straight and visible. Twisting of the layline is an early indication of poor alignment or high tensile loading.

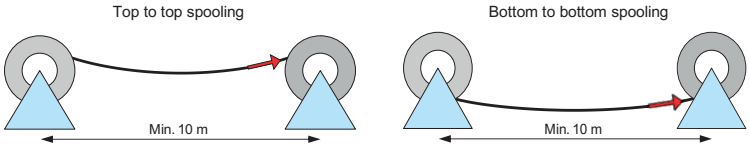

Fig. 1 Hose re-spooling

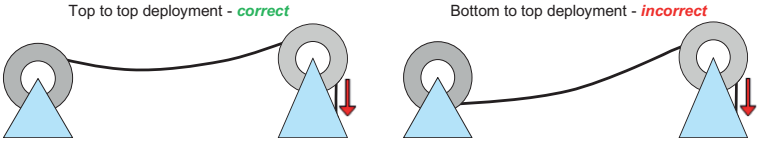

Fig. 2 Hose deployment

5 Possible causes of premature failure, and suggested preventative measures

5.1 Bending the hose below the minimum bend radius

This is most likely to occur if the end fitting is not supported during lifting, a support sling wrongly positioned, or the hose being pulled around a tight corner. It is important that hose should not be bent close to the end fittings. The straight section should be at least two times the outside diameter of the hose before it starts to bend.

Bend restrictors, lifting clamps and containment grips are useful accessories that help to reduce this type of handling problem.

5.2 Damage of the hose cover

Polyflex ColorGard™ extra thick, dual colour cover significantly reduces the risk of exposing the reinforcing wires. If the outer black cover has been abraded to the point that the "early warning" red inner cover can be seen, but the wire reinforcement has not been exposed, the assembly is still fit for use but shall be scheduled for inspection. Alternatively, a repair according to section 7.1.1 may be considered.

If the hose cover is damaged to the extent that the reinforcing wires are exposed, localized corrosion of the wires could occur causing a progressive reduction in burst pressure, and ultimately failure.

If used subsea, a damaged cover will allow water to ingress into the carcass of the hose and could cause the corrosion of the wire reinforcement and/or collapse of the core tube.

It is strongly recommended to immediately remove from service any hose assembly with exposed wires. See also section 7.1.2 for details. A Parker Polyflex specialized testing facility should be contacted and the procedure described in section 6.5.1 shall be followed.

5.3 Kinked, crushed, or twisted hose

If a visible distortion of the hose occurred (kinked, crushed, twisted) it will have an impact on the function and lifetime of the hose. Reduction of burst pressure and external collapse pressure could result in a sudden failure of the hose assembly. This distortion can be caused by a high tensile load or other factors.

Maintaining pressure in the hose will significantly reduce the risk of such distortion occurring.

5.4 Chemical attack or ageing of the core tube

The use of chemicals at differing concentrations and/or temperatures can have a major effect on the life of a hose assembly and may cause dramatic hose failure. It is important to reference the chemical compatibility chart in the appendix of this document and keep the temperatures and concentrations within the specified limits.

Note:
It is critical that the hose is thoroughly flushed with water after each use.

If the hose is not flushed, the concentration of the fluid that is left in the assembly can increase and cause localised failure of the core tube.

5.5 Damage or corrosion of the end fitting

Incorrect handling or insufficient flushing after use could result in damage or corrosion of the end fitting. This will make connection difficult, probably cause leakage, and could result in sudden failure of the connection.

5.6 Flow rates

Depending on the abrasive properties of the fluid, high flow rates can result in erosion in the core tube or in the bore of the end fitting.

The maximum recommended flow rate is 15 m/sec, although much higher rates have been used short term with non-abrasive fluids. Note possible temperature increase because of high flow velocities.

Note:
The condition of the core tube and end fittings are checked as part of inspection (see 6.2).

6 Inspection guidelines

6.1 General

Hoses and hose assemblies have a limited lifetime and if they are not properly maintained, they could fail in service, causing expensive damages of property, unnecessary downtimes, release of hazardous substances and personnel injuries.

Properly planned inspections, preventive actions and timely hose replacements are highly recommended to ensure safety and are less expensive than replacements or repairs of hose assemblies after a failure.

Parker is recommending inspection and re-testing of Black Eagle Hoses on a regular basis.

6.2 Frequencies and Levels of Inspection

The table below represents the general Parker recommendation. However, due to huge variances in operating conditions in various applications, the final responsibility to define proper inspection intervals and amount of inspection is within the hose assembly owner/user.

Some factors, which could be taken into account while defining inspection intervals and amount of inspection, are listed below:

- Operating pressures
- Operating temperatures
- Operating times
- Service fluid type, density & viscosity
- PH levels, Chloride content
- Concentration of acids (i.e. HCL, …)
- Flow rates (fluids, gas)
- Sand content (erosion monitoring) or other abrasive materials
- Additional stress levels (i.e. tensile loads)

It is also recommended to review these operating parameters in order to best evaluate the condition of a used Black Eagle hose assembly.

The history of each assembly should be logged showing the results of previous inspections and any repairs.

Recommended Frequencies of Inspection		
Pre- and post-job	**Every 6 months or during installation/ removal**	**Every 2 years**
See 6.3.	Level 1, see 6.4	Level 2, see 6.5

6.3 Routine in-field Pre Job and Post Job Maintenance, Inspection and testing

6.3.1 Routine in-field Pre Job Maintenance, Inspection and testing

The operator shall visually inspect the hose assembly before every job. If any of the following conditions are found the hose shall be removed from service and scheduled for Level 1 inspection.

- Damage to the outer cover which exposes the reinforcing wires.
- Kinked, crushed, or twisted hose.
- Reduction in the outside diameter of the hose.
- Blistered, soft, degraded, or loose outer cover.
- Cracked, damaged, or badly corroded fittings.

If in doubt, contact the original supplier or a Parker Polyflex specialized testing facility for advice.

Regular in-field pressure testing, (normally required after attaching connectors prior to hose deployment), should be restricted to a test pressure of 1.1× actual operating pressure, or the maximum stated working pressure of the hose assembly. Test duration should be 15 minutes. Preferably use water for pressure testing. The hose shall be monitored during the test and observed for signs of leakage in the hose and fittings, any bulging of the hose body, twisting or any abnormal distortion.

Prior to all pressure testing it must be ensured that all air is purged out of the hose. Failure to do so may result in core tube failure. To control that all air is removed it is sufficient to observe that the fluid flow leaving the hose is steady and constant for minimum of 5 minutes without any air bubbles or pulsations.

6.3.2 Routine in-field Post Job Maintenance, Inspection and testing

On completion of each operation both inside and outside hose surfaces should be flushed / cleaned with sufficient clean water to ensure that all chemicals or residues are fully removed from the hose assembly.

The operator shall visually inspect the hose assembly during every recovery. If any of the following conditions are found the assembly shall be removed from service and scheduled for Level 1 inspection.

- Damage to the outer cover which exposes the reinforcing wires.
- Kinked, crushed, or twisted hose.
- Reduction in the outside diameter of the hose.
- Blistered, soft, degraded, or loose outer cover.
- Cracked, damaged, or badly corroded fittings.

If in doubt, contact the original supplier or a Parker Polyflex specialised testing facility for advice.

6.4 Level 1 – On Site Inspection by User

The Black Eagle hose assembly shall be inspected on site by highly skilled users, who have experience and knowledge in using Black Eagle hoses. All observations should be noted and logged.

Recommended Inspection Amount

- Visual inspection
- Hose core tube inspection with borescope
- Hydrostatic pressure test

6.4.1 Level 1 – Visual Inspection

For this purpose, the hose assembly should be cleaned inside and outside with water to remove oily traces, dirt, etc. for good viewing results.

The outer cover of the hose body shall be visually inspected for signs of leakage, excessive wear, looseness, kinks, bubbles, bulges, abrasion or cuts. The back side of a bend restrictor (if used) and the hose area behind the fitting should be checked for signs of over-bending/ kinking. The end fittings shall be checked for any signs of leakage, cracks and far advanced corrosion.

See 7.1 for possible hose repairs.

6.4.2 Level 1 – Hose core tube inspection with a borescope

A suitable video scope equipment is required to inspect the hose core tube and the inside surface of the fittings. Inspect the cleaned hose core tube for colour change, cracks, blisters or erosion. Hoses that have been exposed to pressurized gases should be inspected thoroughly to determine, if the integrity of the liner has been breached or the liner has collapsed. If bulges, blisters, punctures or any other damage of the core tube is detected, the hose shall be removed from service and be replaced.

Some Parker Polyflex hoses have a special feature of ColorGard™ core tube. With black inside layer and yellow outside one, damage to core tube becomes visible.
If the hose core tube is damaged to the extent that yellow layer is exposed, hose shall be removed from service.

6.4.3 Level 1 – Hydrostatic pressure test

See 6.3.1 for details.

6.5 Level 2 – Inspection/Recertification by a Parker Certified Facility

To be able to perform “Level 2” inspections and re-certifications of Black Eagle hose assemblies, dedicated equipment, personnel and expertise is required. Parker Polyflex have trained and certified specialized facilities and their personnel to assemble, inspect, test, repair and recertify hose assemblies. Their equipment includes:

- Inspection equipment (i.e. videoscopic camera)
- Manufacturing equipment (i.e. a suitable crimper with enough crimping force, die sets, gauges)
- High volume filling pumps for preparing pressure tests
- Testing equipment/ pressure test unit with the possibility to record pressure test graphs
- Safe testing chamber

Hose management is an essential part of the service they provide.

If necessary, the Black Eagle hose assemblies shall be decommissioned from the installation and returned to Parker Polyflex or a certified facility.
Level 2 inspections shall be conducted, if possible, during a regular equipment shutdown.

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After completion of Level 2 inspection, customer will receive detailed report of the findings, including recommended actions:

- Repair (see 8.1)
- recertification (see 8.2)
- scrapping

6.5.1 Customer Pre-dispatch procedure before returning a hose assembly for Level 2 inspection

- The object is to make sure the hose assembly can be safely handled and the condition of the assembly will justify the transportation and inspection costs.
- The chosen inspection facility should be contacted if doubtful about any of the points below.
- Check and record assembly serial number (send information to test facility).
- Assembly must be free of chemical residues inside and outside.
  (could result in refusal to handle returned assembly)
- Report on any findings out of section 6.3.1
- Method of transport, size and weight, (Long length hose assemblies on drums or reels may require special handling equipment such as drums and re-spooling machinery).
- Customer will receive a budget price for inspection based on the information given by the end user.

6.5.2 Level 2 - Recommended Inspection Amount

- Safety inspection, condition of assembly as received.
  - Check for chemical residue inside and outside (may require flushing or cleaning).
  - Assembly serial number (check assembly history including previous repairs).
- External inspection
- Internal inspection
- Inspection report

6.5.3 Level 2 - External inspection

- Damage to the outer cover (abrasion, incorrect routing)
- Exposed reinforcing wires. (damaged outer cover)
- Kinked, crushed, or twisted hose. (high tensile loading, incorrect routing)
- Reduction in the outside diameter of the hose (high tensile loading with no pressure)
- Blistered, soft, degraded, or loose outer cover. (chemical attack, leaking fitting, permeation or high temperature)
- Cracked, damaged, or badly corroded fittings (chemical attack, poor handling, old hose assembly)
- Damage or wear on fitting threads (poor handling, old hose assembly)
- Condition of containment grips / clamps. (abrasion, frayed wires, distortion)

6.5.4 Level 2 - Internal inspection

Internal inspection will be done with a borescope.

- Check for damage to bore of fittings, cracks, severe abrasion and corrosion.
- Check for damages, bulges, cracks and blisters of core tube at the back of fittings (critical area).
- Scope maximum length of the core tube possible. Recommended minimum is 10 m both sides.
- Hose assemblies shorter than 20 m should be scoped on the complete length.

- Look for uneven surface (sign of wire fatigue, abrasion, chemical attack).

6.5.5 Level 2 - Inspection report

The testing facility will advise on the overall condition of the hose and end connections.

Customer will receive detailed report of the findings, including recommended actions:

- Repair (see 7.1)
- recertification (see 7.2)
- scrapping

7 Procedure for repair and recertification

7.1 Repair

It is recommended, that all repairs are done by certified specialized testing facilities. Some repairs (see examples below) could be done in field. Be sure to maintain safety requirements.

7.1.1 Twisted hose, hose with the reduced OD, flattened hose

A hose with signs of twisting or deformation will need to be unreeled, as straight as possible, from the winch/drum in a safe environment and pressurized to working pressure for at least 1 hour and then pressure released. The hose shall be re-inspected to see if the hose has returned to its “untwisted, undistorted” original shape. If so the hose should be again pressurized before rewinding back onto the winch/drum. Any sections of hose still misshapen should be cut out of the assembly.

7.1.2 Hose with cover damage

- No reinforcement wires exposed.

Temporary solution, the damaged area can be cleaned and protected by wrapping with a strong adhesive “duct / riggers” tape. If abraded to the point where the red ColorGard is visible, the damaged area should be thoroughly cleaned with mild solvent, a thin plastic sheet wrapped around the hose to form a mould. A two pack polyurethane mixture can then be poured into the mould and allowed to set. Remove mould after the polyurethane is set. Also, a repair procedure acc. to Appendix 3 might be applied.

- Reinforcement wires exposed.

It is strongly recommended to remove the hose assembly from service immediately. Any ingress of water into hose carcass will initiate corrosion of the reinforcement wire. It is difficult to estimate the rate of corrosion. At best, the hose could function for months, at worst, possibly less than one week. It is also possible that the core tube could have collapsed if the external pressure acting within the carcass is greater than internal pressure within the hose.

In any case, the lifetime of the hose assembly will be significantly reduced, and the hose assembly shall be immediately scheduled for inspection at certified specialized testing facility.

Decision to further use a hose assembly with exposed wire shall be based on a proof pressure test for 1.1× maximum working pressure of the hose assembly. This test shall be conducted prior to every further job.

Repair of such a hose assembly is possible, but it will include cutting out the section of the hose, where the wires have been subjected to water. Obviously, this will require new fittings to be crimped and hose assembly to be proof pressure tested. Procedure for proof pressure testing in this case is specified in the assembly instructions for the appropriate hose type.

After successfully passing pressure test, hose assembly shall be permanently marked with the new recertification date (see 7.2).

The testing facility will recommend if the condition of the hose warrants the cost of assembling new fittings, joining the lengths together and proof testing.

7.1.3 Fitting re-ending

In case of fitting damage or hose damage near fitting (usually due to kinking) it is allowed to cut off the fitting and replace it by a new one. This can be done by Parker certified facilities only and will require pressure test at 1.5 x maximum working pressure of hose assembly. Recommended testing time = 15 minutes.

7.2 Recertification

Recertification shall include Level 2 inspection acc. to section 6.5.2 and a hydrostatic pressure test.

Unless otherwise agreed between customer and test facility, test conditions are:

Test pressure = 1.5× maximum working pressure of hose assembly. Allow for at least 30 minutes stabilization time before starting recording pressure decay.

Pressure hold time = 1 hour

Pressure decrease of maximum 5% is allowed.

To avoid hose damage due to excessive pressurizations, it is recommended to limit the number of pressure tests to 1.5 x maximum working pressure to 20 for the lifetime of the hose assembly. This may include pressure testing during recertification as well as pressure testing after fitting re-ending.

After successfully passing pressure test, hose assembly shall be permanently marked with the word RECERT plus the consecutive number of recertification, i.e. “RECERT- 3” and recertification date.

It is recommended to keep the number of recertifications limited to 10 times.

8 Parker Certified Distributors/ Service Addresses

The below listed companies have been certified by Parker Polyflex to manufacture, inspect and re-certify Black Eagle hose assemblies:

- Abdex Industries WA, 49A Sustainable Avenue, Bibra Lake, WA 6163, Australia, +61 89418 3044
- Beattie Industrial Ltd., Div. of Newfoundland Offshore, 1345 Topsail Road, PO Box 8398, A1B 3N7 Paradise, NF, Canada, +1 (709) 782-2623
- Flexiflo Corp., PO Box 18532, Jebel Ali Free Zone, Dubai, United Arab Emirates, +971 4 8838131
- Fluid Control AS, Sjøkrigsskoleveien 15, 5165 LAKSEVÅG, Norway, +47 55 94 22 50
- *Hydrasun Group Ltd., Gateway Business Park, Moss Road, Aberdeen AB12 3GQ, United Kingdom, +44 1224 618618 (24 Hrs.)

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- Mento AS, PO.Box 44, Kontinentalveien 22, 4098 Tananger, Norway, +47 51 64 86 00
- Norwesco Industries (1983) Ltd., 6908L - 6th Street S.E., Calgary AB, T2H 2K4, Canada, +1 403 258 3883
- *Parker Hannifin Manufacturing Germany GmbH & Co. KG - FLUID CONNECTORS GROUP - POLYFLEX DIVISION - An der Tuchbleiche 4 - 68623 Lampertheim, Germany, + 49 (0) 6256 81-0
- Parker Hannifin Corporation, Parflex Division, 11151 Cash Road, Stafford, TX 77477, USA, +1 281 566 450

Note: * only these facilities are currently certified to re-end 3” Black Eagle hoses. Level 2 inspection, pressure testing and recertification of all sizes can be done by all above listed facilities.

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Appendix 1: Chemical resistance chart

The below chart contains chemical resistance information for Polyamide 11 (Nylon 11) and Fluoropolymer.

These are the most common core tube materials used for Parker Polyflex oil & gas hoses

Please refer to the hose datasheets for more detailed information.

Rating codes

E	Excellent	Good to excellent. Little or no swelling, tensile or surface change. Preferred choice.
A	Good	Good to excellent. Little or no swelling, tensile or surface change. Limitations with temperature and type of fluid.
B	Limited	Marginal or conditional. Noticeable effects but not necessary indicating lack of serviceability. Further testing is suggested for specific application. Very long-term effects.
X	Unsatisfactory	Poor or unsatisfactory. Not recommended without extensive and realistic testing.
-		Indicates that this was not tested.
*****	Swelling	Increase of volume of material, due to absorption of a solvent.

Material code for hose core tube

N Polyamide

M Coextruded core tube with Fluorpolymer inner liner

Notes on chemical resistance table

The chemical resistance table is a simpified rating tabulation based on immersion tests. Higher temperatures tend to reduce ratings. Since final selection depends on pressure, fluid, ambient temperature and many other factors not known to Parker Hannifin, no performance guarantee is expressed or implied.

The indications do not imply any compliance with standards and regulations and do not refer to possible changes of colour, taste or smell.

Some hose applications must take into account legal and insurance regulations. The chemical resistance indicated does not express or imply approval by certain institutions.

Chemical resistance does not imply low permeation rates. For gas applications, refer to Appendix 4. Note that hoses with coextruded core tube with Fluoropolymer inner liner are not recommended for gas applications.

For fluids, not listed or for advice on particular applications, please contact Parker Hannifin, Polyflex Division in Lampertheim, Germany.

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Chemical	Concentration	N				M
		20°C (68°F)	40°C (104°F)	60°C (140°F)	90°C (194°F)	100°C (212°F)
Acetaldehyde		A	B	X	X	A
Acetic Acid	5%	A	A	A	B	E
Acetic Acid	10%	A	A	B	X	E
Acetic Acid	50%	B	X	X	X	E
Acetic Anhydride		B	X	X	X	E
Acetone	Pure	A	A	B	X	A
Acetylene		A	A	A	-	A
Air		A	A	A	A	A
Aluminium Sulphate	Saturated Solution	A	A	A	A	A
Ammonia	Liquid or Gas	A	A	A	X	A
Ammonium Chloride		A	A	A	-	A
Ammonium Hydroxide	Concentrated	A	A	A	A	A
Ammonium Nitrate		A	A	A	A	A
Ammonium Sulphate	Saturated Solution	A	A	B	-	E
Amyl Acetate		A	A	A	B	A
Aniline		B*	X	X	X	E
Asphalt		A	A	A	A	A
Barium Chloride	Saturated Solution	A	A	A	A	A
Benzaldehyde		A	B	X	X	E
Benzene		A	A*	B	X	E
Butane		A	A	A	A	A
Butyl Alcohol		A*	B	X	X	E
Calcium Arsenate		A	A	A	-	A
Calcium Chloride	Saturated Solution	A	A	A	A	A
Calcium Nitrate		A	A	A	-	A
Camphor		A	-	-	-	A
Carbon Dioxide		A	A	A	A	A

Carbon Monoxide		A	A	A	A	A
Carbon Disulphide		A*	B*	B	X	A
Carbon Tetrachloride		X	X	X	X	A
Cement Slurries		A	A	A	-	A
Chlorinated Solvents		B	X	X	X	E
Chloroform		B	X	X	X	E
Chromic Acid		X	X	X	X	E
Citric Acid	Saturated Solution	A	A	B	X	E
Copper Sulphate		A	A	A	A	A
Cyclohexane		A	A	A	B	A
Cyclohaxanol		A	B	X	X	E
Cyclohexanone		A	B	X	X	E
Diammonium Phosphate		A	A	B	-	E
Dichloroethylene		B	X	X	X	E
Diesel		A	A	A	A	A
Diester Oils		A	A	A	B	A
Diethanolamine	20%	A	A*	A*	B	A
Diethyl Ether		A	-	-	-	E
Dioctylphthalate		A	A	A	B	A
Ethanol	Pure	A*	B	B	X	E
Ethyl Acetate		A	A	A	-	A
Ethylene Glycol		A*	A*	B	X	E
Ethylene Oxide		A	A	X	X	E
Fatty Acid Esters		A	A	A	A	A
Formaldehyde	Technical	A	B	X	X	E
Formic Acid	10%	X	X	X	X	E
Furfuryl Alcohol		A	A*	B	X	E
Gas (Coal)		A	A	-	-	A
Gasoline (High Octane)		A	A	A*	-	A
Glucose		A	A	A	A	A
Glycerine	Pure	A	A	B	X	E

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Glycol		A	A	B	X	A
Heptane		A	A	A*	-	A
Hexane		A	A	A	A	A
Hydrogen		A	A	A	A	A
Hydraulic Fluid (petroleum base)		A	A	A	A	A
Hydraulic Fluid (phosphate ester base)		A	A	A	B	A
Hydraulic Fluid (water base)		A	A	A	A	A
Hydrogen Peroxide	20%	A	B	-	-	E
Hydrochloric Acid	15%	A	B	X	X	E
Hydrochloric Acid	28%	X	X	X	X	E
Hydrochloric Acid	37%	X	X	X	X	A
Hydrofluoric Acid	3%	A	B	X	X	E
Isocyanates		B	X	X	X	E
Isooctane		A	A	A	A	A
Isopropyl Alcohol		A	B	X	X	E
Kerosene		A	A	A*	B	A
Lactic Acid		A	A	A	B	E
LP Gas		A	A	A	A	E
Magnesium Chloride	50%	A	A	A	A	A
Mercury		A	A	A	A	A
Methane		A	A	A	A	E
Methanol	Pure	A	B	B*	X	E
Methyl-Cellosolve		A	A	A	X	A
Methyl Acetate		A	A	A	-	A
Methyl Bromide		A	X	X	X	E
Methyl Chloride		A	X	X	X	E
Methyl Sulfate		A	B	-	-	E
Methyl Ethyl Ketone		A	A	B	X	-
Methyl Isobutyl Ketone		A	A	B	X	E

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Methylene Chloride		X	X	X	X	A
Monochlorobenzene		B	X	X	X	A
Naphta		A	A	A	-	A
Naphtalene		A	A	A	B	A
Natural Gas		A	A	A	A	E
Nitric Acid		X	X	X	X	A
Nitrobenzene		B	X	X	X	A
Nitrogen Gas		A	A	A	A	E
Oil, Crude		A	A	A	B	A
Oils Refined		A	A	A	B	A
Oleic Acid		A	A	A	B	A
Oxalic Acid		A	A	B	X	E
Oxygen Gas		A	A	B	X	A
Perchloric Acid		B	X	X	X	B
Perchloroethylene		B	X	X	X	E
Petroleum Ether		A	A	A	B	E
Phosphoric Acid	50%	A	B	X	X	E
Picric Acid		B	X	X	X	E
Potassium Carbonate		A	A	B	X	E
Potassium Chloride		A	A	B	X	E
Potassium Hydroxide	50%	A	B	X	X	E
Potassium Nitrate		A*	B*	X	X	E
Potassium Sulfate		A	A	A	A	A
Propane		A	A	A	A	A
Propylen Glycol		A	B	X	X	A
Pydraul F9		A	A	A	-	A
Pyridine	Pure	B	X	X	X	E
Sodium Borate		A	A	A	-	A
Sodium Carbonate	Saturated Solution	A	A	B	X	E
Sodium Chloride	Saturated Solution	A	A	A	A	A
Sodium Hydroxide	50%	A	B	X	X	E

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Sodium Hypochlorite	Concentrated	B	X	X	X	E
Sodium Hypochlorite	Dilute Commercial	A	B	X	X	E
Sodium Sulfide		A	A	B	-	E
Stearin		A	B	B	-	E
Stearic Acid		A	A	A	B	A
Styrene Monomer		A	A*	-	-	E
Sulphur Dioxide		B	X	X	X	A
Sulphur Hexafluoride Gas		A	A	A	A	A
Sulphuric Acid	10%	A	B	X	X	A
Sulfic Anhydride		B	X	X	X	E
Tartaric Acid		A	A	A	B	A
Tettraethyl Lead		A	-	-	-	E
Tetrahydrofurane		A	A	B	X	E
Toluene		A	A*	B	B	E
Trichloroethane		B	X	X	X	E
Trichloroethylene		B	X	X	X	E
Tricresyl Phosphate		A	A	A	B	A
Tributyl Phosphate		A	A	A	B	A
Trisodium Phosphate		A	A	A	A	A
Triphenyl Phosphate		A	A	B	-	A
Turpentine		A	A	B	-	A
Urea		A	A	B	B	E
Uric Acid		A	A	A	B	A
Vinegar		A	A	A	-	A
Water		A	A	A	A	A
Water Glycols		A	A	A	B	A
Water, Sea		A	A	A	A	A
Water, Soda		A	A	A	A	A
Xylene		A	A*	B	B	E
Zinc Chloride		A	A	B	X	E

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Appendix 2: Data for tensile loading and weights of Polyflex hoses

Note that all below values of tensile forces include the own weight of the hoses.

The values below have been established based on lab testing (tensile test followed by impulse testing) of short hose assemblies. At the tensile forces stated below the hoses will not elongate more than 30% at the area of highest load (topside). Pressurized hose can take higher tensile load, it will elongate less.

2448N-32V80	Pressure [bar]	0	100	300 and above	
	Max. tensile force [kN]	30	50	100	
2580N-32V80	Pressure [bar]	0	100	300 and above	
	Max. tensile force [kN]	30	50	100	
2648N-32V80	Pressure [bar]	0	100	300 and above	
	Max. tensile force [kN]	30	50	100	
2240N-48V80	Pressure [bar]	0	100 and above		
	Max. tensile force [kN]	30	50		
2440N-48V80	Pressure [bar]	0	100	300 and above	
	Max. tensile force [kN]	60	100	200	
2640N-48V80	Pressure [bar]	0	100	300 and above	
	Max. tensile force [kN]	60	100	200	

In the table below some figures are put together for information

	Hose ID [mm]	**Hose OD** [mm]	**Hose weight in air empty** [kg/m]	**Hose weight in air, full of water** [kg/m]	**Hose weight in water empty** [kg/m]	**Hose weight in water full of water** [kg/m]
2448N-32V80	50,5	80,5	8,5	10,5	3,3	5,3
2580N-32V80	50,5	84,5	9,4	11,5	3,7	5,7
2648N-32V80	50,0	86,0	12,1	14,1	6,2	8,1
2240N-48V80	75,0	114,0	11,5	16,0	1,1	5,6
2440N-48V80	75,0	122,0	18,7	23,2	6,7	11,3

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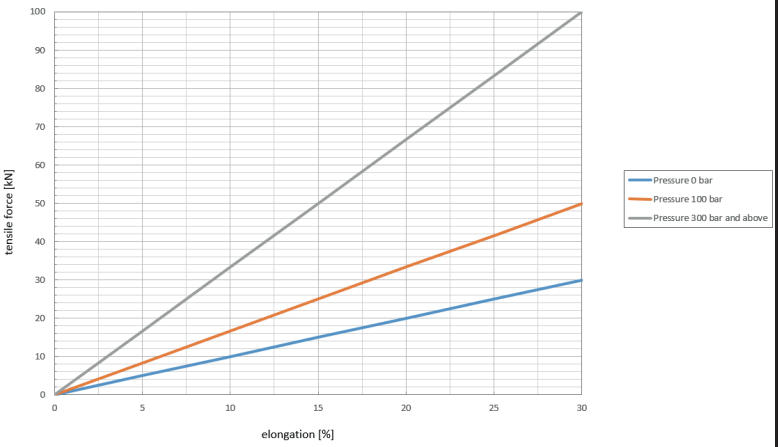
2640N-48V80	75,0	130,0	27,5	32,0	14,0	18,4

1st Example: No pressure. 1000 m length of 2580N-32V80 shall be deployed. Hose weight in water, full of water, 5,7 kg/m × 1000 m = 5700 kg. Max tensile force is 30 kN, therefore a 1000m length is too heavy to deploy in these conditions.

2nd Example: Pressure 300 bar. 1500 m length of 2580N-32V80 shall be deployed. Hose weight in water, full of water, 5,7 kg/m × 1500 m = 8550 kg. Max. tensile force is 100 kN, so a 1500 m length of 2580N-32V80 is OK to deploy when pressurized at 300 bar, and an additional weight of 10000-8550=1450 kg may be added.

The following maximum tensile force over elongation plots indicate which maximum elongation will locally occur at a specific maximum tensile force.

2448N-32V80



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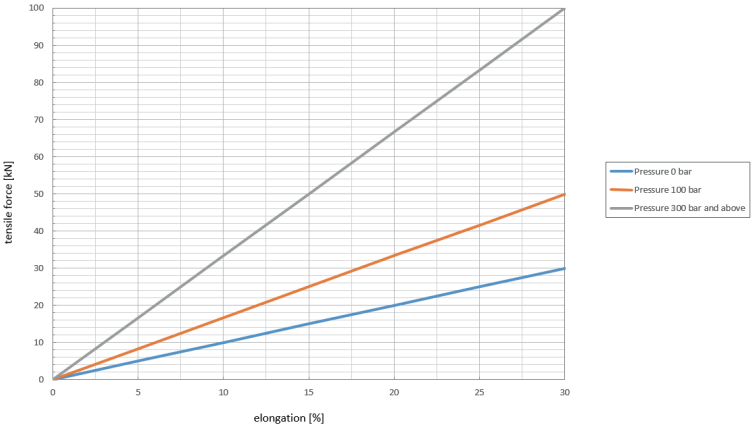
2580N-32V80



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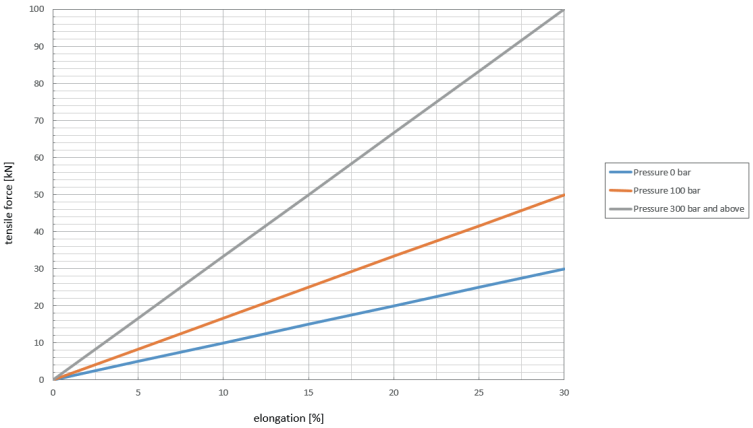
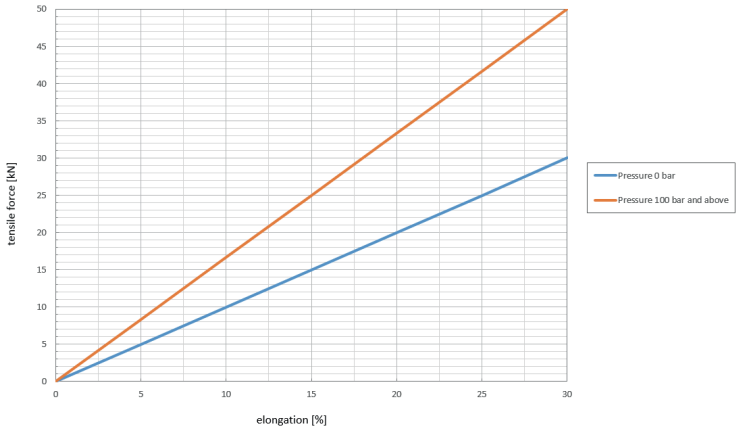
2648N-32V80



2240N-48V80



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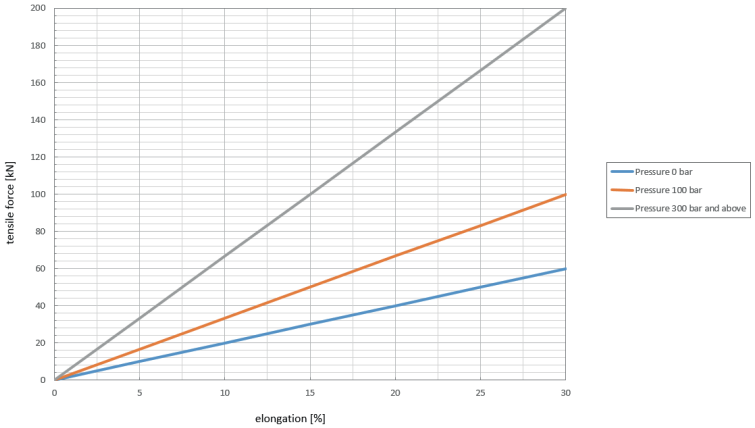
2440N-48V80



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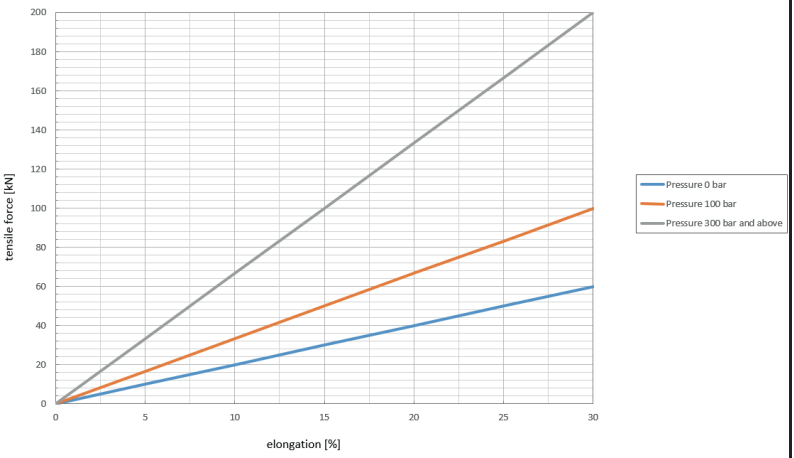
2640N-48V80



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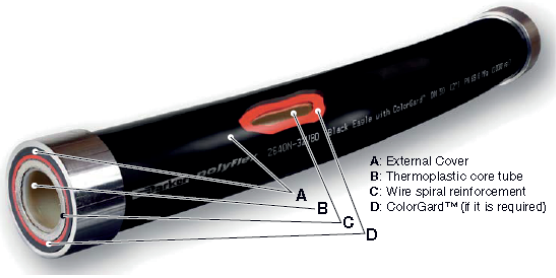
Appendix 3: Procedure for a repair of a local damage in the outer cover

1. Purpose

This engineering standard provides a recommended practice for repair of local outer cover damage on a Polyflex large bore hose. This instruction is valid for hose sizes 1 1/2" (DN 38) up to size 3" (DN 75) with ColorGard™.

Polyflex large bore hoses are being increasingly used subsea, deployed as single line hoses. These hoses are therefore protected by a dual colour outer cover, the extra thick ColorGard™ sheath (see picture):



2. Important Safety Notices

Before repairing a Polyflex hose, carefully read and fully understand the below instructions. Refer to section 7.2.1 to determine whether the repair is allowed.

Follow your local safety regulations and ensure that operators are equipped with appropriate protection. The repair of Polyflex hoses requires a safe use of a hot-air gun.

Incorrect handling may significantly reduce the lifetime of the hose and could cause dramatic failures.

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3. Preparation

Recommended equipment and materials:

- Original Polyflex thermoplastic filling material to enable a permanent and proper compound to the original outer cover of the hose
- Industrial hot-air gun (Temperature min. 650 °C) with a small and removable front nozzle to locally melt the filling material and the damaged area of the outer cover.
- A spoon, knife or a putty knife to locally press/ fill the melted material into the damaged area
- Enough cold water to cool down the heated hose immediately
- Grinding tool and sand paper (grain 60 – 80) to smoothen the repaired spot
- Optional: Anti splatter spray/ silicone spray for final polish after the finished repair

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4. Repair Procedure

4.1 Clean the defective spot with a lint-free cloth or with compressed air. Do not use any cleaning detergent! For the repair, the area must be dry and free of dirt and dust.

4.2 Melt the damaged area with the hot-air gun at approx. 600°C locally. Immediately when the material is melting, use a spoon or putty knife to press the melted material into the damaged area.

Cool the heated area immediately with cold water.

4.3 Visually check the melted area for any holes or remaining gaps.

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4.4 Fill open gaps with melted filling material.	
4.5 Spackle the melted material into the gaps by using a putty knife or similar. Make sure that enough melted material is used for the repair. **ATTENTION:** **DO NOT OVERHEAT THE HOSE.** **STOP HEATING IMMEDIATELY AFTER MATERIAL IS STARTING TO MELT!**	

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4.6 Cool down the area with cold water in order to avoid any heat damages of the hose.	
4.7 Remove excessive filling material by using a grinding tool. The grain of the tool / grinding paper should be approx. 60 - 80	

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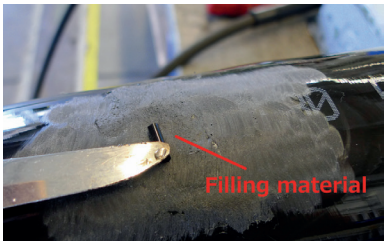
4.8 By grinding the repaired area, unfilled gaps might become visible. These gaps shall be filled by following step 4.4 to 4.



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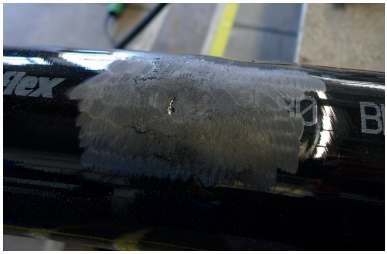
4.9 Remove excessive melted filling material with a grinding tool (see 4.7)	
4.10 Final grinding by hand with sand paper (Grain = 60 - 80)	 

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4.11 Final finish by locally heating up the repaired area.

ATTENTION:

DO NOT OVERHEAT THE HOSE.

STOP HEATING IMMEDIATELY AFTER

MATERIAL IS STARTING TO SHINE!

Cool down immediately with cold water to avoid any overheating.

4.12 Polish repaired outer cover by using Silicone spray or similar (optional)

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Appendix 4: Recommendations for use of Parker Polyflex Black Eagle hoses with gas and sour gas.

4.1. Use of Black Eagle hoses with gas.

Please refer to Appendix 1 "Chemical compatibility table" for chemical compatibility of core tube materials with gases. However, good chemical compatibility is not the only parameter to consider for gas use. The other key parameter is permeability. Permeation could lead to different potential failure modes. One is hose cover blistering and another is core tube collapse due to rapid gas decompression and/or gas trapped under pressure between hose layers.

Permeability is defined as the ability of a substance to allow another substance to pass through it. For a circular tube, it is calculated per the below formula:

V=PW*A*T*P/S

V - volume of gas, in cm^3, which diffuses through
PW - permeability coefficient, $cm^3*mm/m^2*day*bar$, see table below
A - is the area across which the gas diffuses, in m^2
S - thickness of tube, in mm
T - diffusion time, in days
P - pressure difference across the tube, in bar

PW values for various gases, cm3*mm/m2*d*bar	N2	Air	O2	CO2	H2	He	CH4
PA11, methanol washed	5	7	21	60	130		6
PA12	9	13	43	105	900	500	14
POM	2	3	4	20	80		

These guidance values are taken from literature. They are based on room temperature.
Higher temperatures significantly increase permeation rates.
Actual behavior may vary considerably because of variations in processing.

The below simplified estimation formula is a result of recalculations based on the typical core tube thickness and area of Polyflex hoses.

V=K* PW*P

V - volume of gas, in cm^3 per core tube meter per day, which diffuses through
K – recalculation coefficient for area and thickness, see table below
PW - permeability coefficient, $cm^3*mm/m^2*d*bar$, see table above
P - pressure difference across the tube, in bar

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K coefficients for hose sizes

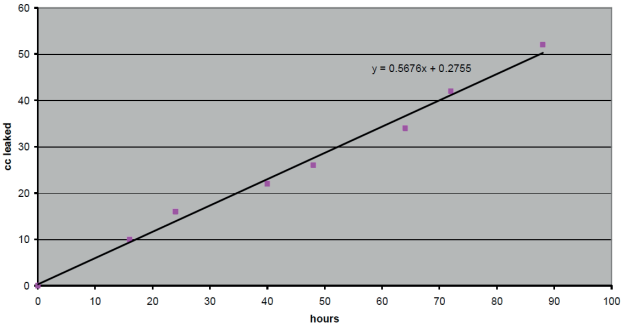
-04	-05	-06	-08	-12	-16	-20	-24	-32	-48
0,017	0,019	0,021	0,027	0,035	0,040	0,044	0,048	0,053	0,048

Example: how much CH4 would permeate through core tube of a 2" hose at 10000 psi.

V=0,053*6*690=219,42 cm³ per core tube meter per day

As previously mentioned, all the calculated values can be used for estimation only. Permeation coefficients are just literature values for lab conditions, permeation through hose cover is not considered.

As an example, permeation of CH4 at 1 meter sample of 2" hose has been measured at 170 bar and ambient temperature and the result is represented on the below graph. The above calculation would result in a value of V=0,053*6*170=54,06 cm³ per core tube meter per day, which would mean 2,25 cm³ per hour, and only approx. 0,57 cm³ per hour have been measured.



Note that in all previous discussions gas which permeates through the core tube was mentioned. Obviously, there is one more barrier – hose cover. If cover is pin-pricked, gas will easily go through it and no issues will occur. But pin-pricking is not acceptable for subsea service as the reinforcement wires will corrode. In addition, collapse resistance of hose would be compromised. For land based operations, all Parker Polyflex hoses may be pin-pricked.

Pin-pricking is not required on hoses with Colorgard. Performance of those hoses with gas has been confirmed by several tests. Test summary is provided below.

Without pin-pricking, gas will also have to permeate though the hose cover. The formula for calculation is the same as for core tube, only other permeability coefficients shall be used. Parker hoses are designed in the way that cover material has higher permeability coefficient compared to core tube, so more gas can permeate though the cover. In addition, area of permeation is larger. Thick cover is rigid enough to withstand any possible pressure build up in the hose annulus without building blisters.

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Hose type	Test description	Test gas	Test pressure and temperature	Test results
2640N-24V80	Pre-conditioning of hose: 24 hours soak in methanol at room temperature and atmospheric pressure. Pressurize with test gas mixture for 12 hours. Decompress at 20 bar/min. Leave for 1 hour. Repeat this pressure cycle two more times.	Gas mixture 97/3 CH4/CO2	740 bar (10730 psi) at 25°C	No signs of blistering or slitting and no decompression damage have been found on hose core tube at a magnification of X20.
2640N-24V80	Pressurize with test gas at 345 bar for 24 hours. Decompress at 70 bar/min. Leave for at least 12 hours. Repeat this pressure cycle two more times.	N2	345 bar (5000 psi) at ambient temperature	No signs of blistering or slitting and no decompression damage have been found on hose cover at a magnification of X20.
2640N-32V80, also valid for 2580N-32V80	Pressurize with test gas at 690 bar for 30 days and slowly decompress (decompression rate not noted). Pressure test with water 20 times at 1035 bar for 60 sec. Pressure test with water at 1035 bar for 1 hour. Pressurize with test gas at 690 bar for 47 days and slowly decompress (decompression rate not noted). Pressure test with water 20 times at 1035 bar for 60 sec. Pressure test with water at 1035 bar for 1 hour. Perform burst test.	Gas mixture 97/3/2 CH4/CO2/ H2S, water added to adjust system pH to 3,5-3,8	690 bar (10000 psi) at 25°C	No deterioration on cover have been found. After all testing, hose passed minimum burst pressure requirements.
2440N-32V80, also valid for 2448N-32V80	Pressurize with Nitrogen at 170 bar for 7 days. Then pressurize with Methane at 170 bar for 45 days.	N2 and CH4	170 bar (2465 psi) at ambient temperature	No leakages at connections and no ballooning of the cover. The bore inspection at about 910 hours revealed that the core tube was perfectly smooth and circular. Hose expands by about 0.6 to 0.8 mm upon inflation to 175 bar, but there is no creep in diameter thereafter. After decompression at the end of testing, it took around 6 hours to return to its original outside diameter.

The situation changes, however, if the hose is in subsea service. With external pressure applied, pressure difference across the cover becomes the limiting factor.

Gas permeating through core tube could stay in the hose annulus between core tube and cover and some pressure will build up there. Due to undefined volume of hose annulus of Polyflex hoses (this is related to hose design and manufacturing), it is not possible to calculate this pressure. And in case of quick hose depressurization this built-up pressure could lead to core tube collapse.

With a hose deployed down from a vessel, the situation becomes even more complicated. External pressure varies over the hose length. Lower part of the hose may have no gas permeation through cover, all gas which has passed through the core tube is creeping up through annulus and starts leaving the hose at the pressure balance point. In this case gas permeates through core tube on the whole length of hose but it permeates through cover only on the part length. Obviously, the volume of gas which needs to locally penetrate through cover is higher. This could lead to blisters on the cover. Quick retrieving of hose (which means external pressure change) could lead to the same phenomena.

Parker Polyflex Black Eagle hoses have been used in gas applications for many years. Based on the lab testing and field experience, multiple number of parameters shall be considered. Therefore, design factor of min. 4:1 should be applied (max. operating pressure should not exceed 25% of minimum burst pressure of the hose). This is also required by ISO 7751. If possible, guards of hose whip restrictors shall be used. Please also refer to Parker Safety Guide 4400-B.1

4.2 Use of Parker Polyflex hoses with sour gas.

Core tube of most of Parker Polyflex Black Eagle hoses is made from Polyamide 11. This material is perfectly resistant to Hydrogen sulfide. Only aqueous solutions which are acidic can lead to an acceleration of polymer degradation. Due to the low acidity and generally low partial pressures of Hydrogen sulfide in crude oil or natural gas this effect can be neglected.

Reinforcement wires are made of very high strength steel. Processing of these wires results in very small grain sizes which reduce the susceptibility of the material to cracking that can be caused by H2S. In addition, contact of wires with H2S is limited to the amount of gas which has permeated through the core tube. This amount is also very low due to low partial pressures. In addition, testing has been conducted: totally 77 days of exposure to 2% of wet H2S at 690 bar (resulting in partial pressure of 13,8 bar (200 psi)) and subsequent burst pressure test and SEM analysis of wires. Minimum burst pressure was achieved and in all the wire samples examined, there was no evidence of microcracks or intergranular fracture, nor was there any evidence of embrittlement.
More attention shall be put to hose fittings. They are in direct contact to fluids and can be subjected to H2S. Some limitations and requirements are listed in ISO 15156 parts 1 to 3 (former NACE MR0175). The usual question “are the fittings NACE compliant?” cannot always be answered with yes or no.

ISO 15156 defines certain requirements for material properties including fabrication. Even if these requirements are met, there are some environmental limitations. In addition, requirements for different equipment may be also different acc. to ISO 15156.

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The two important statements out of ISO 15156 shall be considered.

The behavior of metallic materials in H2S-containing environments is affected by complex interactions of parameters, including the following:
a) chemical composition, method of manufacture, product form, strength, hardness of the material and its local variations, amount of cold work, heat-treatment condition, microstructure, microstructural uniformity, grain size and cleanliness of the material;
b) H2S partial pressure or equivalent concentration in the water phase;
c) chloride ion concentration in the water phase;
d) acidity (pH) of the water phase;
e) presence of sulfur or other oxidants;
f) exposure to non-production fluids;
g) exposure temperature;
h) total tensile stress (applied plus residual);
i) exposure time.

WARNING — CRAs (corrosion-resistant alloys) and other alloys selected using ISO 15156 are resistant to cracking in defined H2S-containing environments in oil and gas production, but not necessarily immune to cracking under all service conditions. It is the equipment user`s responsibility to select the CRAs and other alloys suitable for the intended service.

Below is the list of Parker Polyflex hose fittings for some Black Eagle hoses and the information about use with H2S based on ISO 15156 requirements for “any equipment or component”. Hose fittings are not explicitly listed in ISO 15156.
Note that several fitting types with various materials may exist for the same hose.

Hose type	Fitting series	Nipple material	Shell material	Max. Temp. °C (°F)	Max. partial pressure pH2S, kPa (psi)	Remarks
2440N-20V80	1xxLX-	Duplex 2205	316 or 316Ti	232 (450)	10 (1,5)	Any combination of chloride concentration and in situ pH occurring in production environments is acceptable. If chloride concentration is less than 50 mg/l, no restrictions on pH2S and pH are set.
2640N-24V80	1xx5X-	Duplex 2205	Duplex 2205	232 (450)	10 (1,5)	Any combination of chloride concentration and in situ pH occurring in production environments is acceptable. If chloride concentration is less than 50 mg/l, no restrictions on pH2S and pH are set.
	6xx5X-	4340 Q&T	316 or 316Ti		0,3 (0,05)	Normally, no special precautions are required for the selection of steels for use under these conditions, nevertheless, highly susceptible steels can crack.

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Hose type	Fitting series	Nipple material	Shell material	Max. Temp. °C (°F)	Max. partial pressure pH2S, kPa (psi)	Remarks
2640N-24V80	6xx5X-	Nitronic 50 (S20910)	316 or 316Ti	66 (150)	100 (15)	Any combination of chloride concentration and in situ pH occurring in production environments is acceptable.
2240N-32V10 and 2248N-32V10	1xxS6	4340 Q&T	316 or 316Ti		0,3 (0,05)	Normally, no special precautions are required for the selection of steels for use under these conditions, nevertheless, highly susceptible steels can crack.
2449N-32V10	1xxS8	4340 Q&T	316 or 316Ti		0,3 (0,05)	Normally, no special precautions are required for the selection of steels for use under these conditions, nevertheless, highly susceptible steels can crack.
2448N-32V80 and 2580N-32V80	1xxBL-	4340 Q&T	316 or 316Ti		0,3 (0,05)	Normally, no special precautions are required for the selection of steels for use under these conditions, nevertheless, highly susceptible steels can crack.
		Super Duplex S32750 or S32760	316 or 316Ti		10 (1,5) to 20 (3)*	Any combination of chloride concentration and in situ pH occurring in production environments is acceptable. If chloride concentration is less than 50 mg/l, no restrictions on pH2S and pH are set. * depending on chemical composition of individual material batch
	6XX5X-	4340 Q&T	316 or 316Ti		0,3 (0,05)	Normally, no special precautions are required for the selection of steels for use under these conditions, nevertheless, highly susceptible steels can crack.
		Nitronic 50 (S20910)	316 or 316Ti	66 (150)	100 (15)	Any combination of chloride concentration and in situ pH occurring in production environments is acceptable.
2648N-32V80	1xxCX-	4340 Q&T	316 or 316Ti		0,3 (0,05)	Normally, no special precautions are required for the selection of steels for use under these conditions, nevertheless, highly susceptible steels can crack.
		Inconel 718 (N07718)	316 or 316Ti	135 (275)		Any combination of hydrogen sulfide, chloride concentration, and in situ pH in production environments is acceptable.

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Hose type	Fitting series	Nipple material	Shell material	Max. Temp. °C (°F)	Max. partial pressure pH2S, kPa (psi)	Remarks
2240N-48V80 2440N-48V80	1XXTX- 1XXLX- 1XX5X-	4340 Q&T	316 or 316Ti		0,3 (0,05)	Normally, no special precautions are required for the selection of steels for use under these conditions, nevertheless, highly susceptible steels can crack.
2640N-48V80	1XXTX- 1XXLX- 1XX5X-	4140 Q&T	316 or 316Ti			Normally, no special precautions are required.
2440N-48V80	1XXLX-	Inconel 625 (N06625)	316 or 316Ti			These materials have been used without restriction on temperature, pH2S, chloride concentration, or in situ pH in production environments. No limits on individual parameters are set, but some combinations of the values of these parameters might not be acceptable.

4.4 Pressure drop and flow rate

Pressure drop tables for different hose sizes

Remarks

Figures shown in the table are for 1 m of hose without fittings.
Figures derived from calculation, not from testing.
Fluid is water at 20°C
The recommended max fluid velocity is 15 m/s. Hoses have been used at higher fluid velocities. However this may result in cavitation. These flow figures are marked with a grey background.

Flowrates 50 l/min. up to 4500 l/min. sizes 32 mm (-20) up to 76 mm (-48)

Flowrate						
l/min	US Gal/min	Oilfield BBL/min	32 mm -20	38 mm -24	50 mm -32	76 mm -48
50	13	0,31	0,00	0,00	0,00	0,00
100	26	0,62	0,01	0,01	0,00	0,00
150	40	0,95	0,03	0,01	0,00	0,00
200	53	1,26	0,05	0,02	0,01	0,00
250	66	1,57	0,07	0,03	0,01	0,00
300	79	1,88	0,10	0,04	0,01	0,00
400	106	2,52	0,17	0,07	0,02	0,00
500	132	3,14	0,26	0,11	0,03	0,00
700	185	4,41	0,49	0,21	0,05	0,01
1000	264	6,29	0,94	0,40	0,10	0,01
1500	396	9,43		0,86	0,21	0,03
2000	528	12,57			0,36	0,05
3000	793	18,88				0,11
3500	925	22,02				0,14
4000	1057	25,17				0,18
4500	1189	28,30				0,22

Parker's Motion & Control Technologies

At Parker, we're guided by a relentless drive to help our customers become more productive and achieve higher levels of profitability by engineering the best systems for their requirements.
It means looking at customer applications from many angles to find new ways to create value. Whatever the motion and control technology need, Parker has the experience, breadth of product and global reach to consistently deliver. No company knows more about motion and control technology than Parker.

For further info call 00800 27 27 5374

Aerospace

Key Markets

- Aftermarket services
- Commercial transports
- Engines
- General & business aviation
- Helicopters
- Launch vehicles
- Military aircraft
- Missiles
- Power generation
- Regional transports
- Unmanned aerial vehicles

Key Products

- Control systems & actuation products
- Engine systems & components
- Fluid conveyance systems & components
- Fluid metering, delivery & atomization devices
- Fuel systems & components
- Fuel tank inerting systems
- Hydraulic systems & components
- Thermal management
- Wheels & brakes

Climate Control

Key Markets

- Agriculture
- Air conditioning
- Construction Machinery
- Food & beverage
- Industrial machinery
- Life sciences
- Oil & gas
- Precision cooling
- Process
- Refrigeration
- Transportation

Key Products

- Accumulators
- Advanced actuators
- CO_2 controls
- Electronic controllers
- Filter driers
- Hand shut-off valves
- Heat exchangers
- Hose & fittings
- Pressure regulating valves
- Refrigerant distributors
- Safety relief valves
- Smart pumps
- Thermostatic expansion valves

Hydraulics

Key Markets

- Aerial lift
- Agriculture
- Alternative energy
- Construction machinery
- Forestry
- Industrial machinery
- Machine tools
- Marine
- Material handling
- Mining
- Oil & gas
- Power generation
- Refuse vehicles
- Renewable energy
- Truck hydraulics
- Turf equipment

Key Products

- Accumulators
- Cartridge valves
- Electrohydraulic actuators
- Human machine interfaces
- Hybrid drives
- Hydraulic cylinders
- Hydraulic motors & pumps
- Hydraulic systems
- Hydraulic valves & controls
- Hydrostatic steering
- Integrated hydraulic circuits
- Power take-offs
- Power units
- Rotary actuators
- Sensors

Pneumatics

Key Markets

- Aerospace
- Conveyor & material handling
- Factory automation
- Life science & medical
- Machine tools
- Packaging machinery
- Transportation & automotive

Key Products

- Air preparation
- Brass fittings & valves
- Manifolds
- Pneumatic accessories
- Pneumatic actuators & grippers
- Pneumatic valves & controls
- Quick disconnects
- Rotary actuators
- Rubber & thermoplastic hose & couplings
- Structural extrusions
- Thermoplastic tubing & fittings
- Vacuum generators, cups & sensors

Parker

Electromechanical

Key Markets

- Aerospace
- Factory automation
- Life science & medical
- Machine tools
- Packaging machinery
- Paper machinery
- Plastics machinery & converting
- Primary metals
- Semiconductor & electronics
- Textile
- Wire & cable

Key Products

- AC/DC drives & systems
- Electric actuators, gantry robots & slides
- Electrohydrostatic actuation systems
- Electromechanical actuation systems
- Human machine interface
- Linear motors
- Stepper motors, servo motors, drives & controls
- Structural extrusions

Filtration

Key Markets

- Aerospace
- Food & beverage
- Industrial plant & equipment
- Life sciences
- Marine
- Mobile equipment
- Oil & gas
- Power generation & renewable energy
- Process
- Transportation
- Water Purification

Key Products

- Analytical gas generators
- Compressed air filters & dryers
- Engine air, coolant, fuel & oil filtration systems
- Fluid condition monitoring systems
- Hydraulic & lubrication filters
- Hydrogen, nitrogen & zero air generators
- Instrumentation filters
- Membrane & fiber filters
- Microfiltration
- Sterile air filtration
- Water desalination & purification filters & systems

Fluid & Gas Handling

Key Markets

- Aerial lift
- Agriculture
- Bulk chemical handling
- Construction machinery
- Food & beverage
- Fuel & gas delivery
- Industrial machinery
- Life sciences
- Marine
- Mining
- Mobile
- Oil & gas
- Renewable energy
- Solenoid valves
- Transportation

Key Products

- Check valves
- Connectors for low pressure fluid conveyance
- Deep sea umbilicals
- Diagnostic equipment
- Hose couplings
- Industrial hose
- Mooring systems & power cables
- PTFE hose & tubing
- Quick couplings
- Rubber & thermoplastic hose
- Tube fittings & adapters
- Tubing & plastic fittings

Process Control

Key Markets

- Alternative fuels
- Biopharmaceuticals
- Chemical & refining
- Food & beverage
- Marine & shipbuilding
- Medical & dental
- Microelectronics
- Nuclear Power
- Offshore oil exploration
- Oil & gas
- Pharmaceuticals
- Power generation
- Pulp & paper
- Steel
- Water/wastewater

Key Products

- Analytical Instruments
- Analytical sample conditioning products & systems
- Chemical injection fittings & valves
- Fluoropolymer chemical delivery fittings, valves & pumps
- High purity gas delivery fittings, valves, regulators & digital flow controllers
- Industrial mass flow meters/controllers
- Permanent no-weld tube fittings
- Precision industrial regulators & flow controllers
- Process control double block & bleeds
- Process control fittings, valves, regulators & manifold valves

Sealing & Shielding

Key Markets

- Aerospace
- Chemical processing
- Consumer
- Fluid power
- General industrial
- Information technology
- Life sciences
- Microelectronics
- Military
- Oil & gas
- Power generation
- Renewable energy
- Telecommunications
- Transportation

Key Products

- Dynamic seals
- Elastomeric o-rings
- Electro-medical instrument design & assembly
- EMI shielding
- Extruded & precision-cut, fabricated elastomeric seals
- High temperature metal seals
- Homogeneous & inserted elastomeric shapes
- Medical device fabrication & assembly
- Metal & plastic retained composite seals
- Shielded optical windows
- Silicone tubing & extrusions
- Thermal management
- Vibration dampening

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