

## Transaqua HT2-N

Water-based subsea production control fluid

### Description

Castrol Transaqua HT2-N is a water-based hydraulic control fluid specially formulated for use as the control medium in surface and subsea production control system in the Norwegian sector of the North Sea. The fluid incorporates all the features required for operation in a wide range of equipment, and can therefore be used as the operating medium throughout the control system including subsurface safety valve and well control areas.

Castrol Transaqua HT2-N has been developed and qualified under a Quality Management System with ISO 9001:2000 certification and an Environmental Management System with ISO 14001:2004 certification for Research and Development.

### Application

- Castrol Transaqua HT2-N is designed specifically for use in all conventional and high pressure, high temperature applications.
- Can operate over a temperature range of -30°C (-22°F) to 170°C (338°F).
- Track record of use in subsea production control systems at temperatures up to 170°C (338°F)
- Castrol Transaqua HT2-N is tolerant of the high well temperatures encountered by those parts of the control system located at the well bore.
- The low pour point also allows use in areas where low ambient temperatures prevail.
- Designed for use within Electro-Hydraulic Multiplex (EH-Mux) or direct hydraulic control systems.
- Designed for reliable use throughout the entire production and workover control system, covering Topsides and Subsea applications: both open water and well bore; and Downhole from control of a single SSSV through to complex intelligent well completions.

### Advantages

- Fully compliant with OSPAR environmental legislation.
- Castrol Transaqua HT2-N has an identical formulation to the field proven Castrol Transaqua HT2 but with the UV tracer and anti-foaming additives removed.
- Essentially identical performance to Castrol Transaqua HT and Castrol Transaqua HT2 with an operating capability up to 180°C (356°F). See Table 1 & Table 2 for detailed physical and performance characteristics.
- Castrol Transaqua HT2-N contains a yellow metal passivator.
- Castrol Transaqua HT2-N is fully compatible and miscible in all proportions with Castrol Transaqua range and most other water-based subsea control fluids.
- As with all glycol based control fluids, Castrol Transaqua HT2-N must never be mixed with control fluids of different base types such as synthetic fluids (e.g. Castrol Brayco Micronic SV/3) or mineral oils (such as the Castrol Hyspin range). Contamination of Castrol Transaqua HT2-N by either of these types of products can seriously affect the product performance.
- Castrol Transaqua HT2-N is resistant to bacterial and fungal growth.
- Castrol Transaqua HT2-N is stable with seawater contamination.
- Castrol Transaqua HT2-N is compatible with a wide range of materials commonly used in subsea control systems, for basic lists see Table 3 & Table 4.
- Proven track record of Castrol Transaqua series chemistry.
- Allows reliable operation of subsea equipment exposed to conventional or HP/HT conditions.
- Compatibility and miscibility properties of Castrol Transaqua HT2-N with other water based control fluids allow

for easily managed direct top up and upgrade option programme. For further details contact Castrol Offshore.

- The chemistry of the fluid allows operation at low ambient temperature environments and inhibits hydrate formation.

## Technical Data

### Typical Physical Characteristics

Table 1							
Fluid - Castrol Transaqua HT2-N Rheology @ Ambient Pressure							
Property	@ units	-25°C (-13°F)	0°C (32°F)	20°C (68°F)	40°C (104°F)	100°C (212°F)	175°C (347°F)
Density	g/ml	1.0880	1.0741	1.0630	1.0519	1.0186	0.9770
	lb/ft <sup>3</sup>	67.92	67.05	66.36	65.67	63.59	60.99
Viscosity	mm <sup>2</sup> /s	29.18	8.17	3.95	2.25	0.74	0.34
Bulk Modulus	N/m <sup>2</sup> (x 10 <sup>9</sup> )	2.75	2.74	2.70	2.64	2.29	1.52
	psi (x10 <sup>5</sup> )	3.99	3.98	3.92	3.83	3.33	2.20

Castrol Offshore Ltd has comprehensive PVT data available, which covers a range of pressure and temperatures upon request.

General Properties			
Property	Code	Units	Typical Value
Appearance			Clear mobile fluid
Colour			Pale straw
Pour Point	IP15 / ASTM D97	°C (°F)	-39 (-38.2)
Flash Point	ASTM D92	°C(°F)	N/A as water based
pH @ 20°C (68°F)			8.9
TAN	IP177 / ASTM D664	mg KOH/g	2.61
TBN	IP276 / ASTM D2896	mg KOH/g	15.21
Coefficient of Thermal Expansion		m <sup>3</sup> /m <sup>3</sup> °C	0.00052
Thermal Conductivity	ASTM D2717	W/m/°C	0.42
Specific Heat	ASTM D2766	Kj/Kg/K	3.257
Foam Test Sequence 1 Tendency	IP146 / ASTM D892	ml	750 maximum
Foam Test sequence 1 Stability	IP146 / ASTM D892	ml	0
Viscosity Index (VI)	ASTM D2270		N/A as water based
Moisture Content Volumetric-Karl Fischer	IP386	p.p.m.	N/A as water based
Relative Humidity	CWS01	%	N/A as water based
Particulate Cleanliness	SAE AS4059E		Class 6 B to F or better
	ISO 4406		Code -/14/11 or better

**Table 2**

<b>Fluid - Castrol Transaqua HT2-N</b> <b>Typical Performance Characteristics</b> (Based on typical performance of Transaqua HT & HT2, unless otherwise stated).			
Property		Code	Performance
Sea Water Stability		ISO 13628-6 Annex C (2006 E)	Stable to 10% sea water contamination. Provides anti-corrosion performance on carbon steel with 10% sea water.
Microbiological Growth - 28 Day Challenge Test Fungi Bacteria		ISO 13628-6 Annex C (2006 E)	Based on sterile during after test.
Lubrication Shell 4 Ball - Mean Wear Scar Diameter (1hr, 30kg, 1460 rpm)		IP239	0.958 mm.
Environmental Performance		OSPAR Requirements	Meets OSPAR requirements - all components tested for toxicity (4 species), biodegradation and bioaccumulation. (Transaqua HT2-N tested)
Compatibility	Metals	ISO 13628-6 Annex C (2006 E)	Compatible with a wide range of metals for a core set of commonly used metals see Table 3.
	elastomers/ Plastics	ISO 13628-6 Annex C (2006 E)	Compatible with a wide range of Elastomers/ plastics for a core set of commonly used components see Table 4.
	Umbilical Testing	API 17E	Based on 3 month compatibility testing completed successfully on HT & HT2.
Valve Testing	DCV	OEM specific	See Castrol Offshore for details of testing carried out with Aker and Rotator systems.
	SSSV	OEM specific & OTO99001	

For a more extensive list of tested materials and detailed information on testing contact Castrol Offshore.

<b>Table 3</b>		
<b>Fluid - Castrol Transaqua HT2-N Metal Compatibility</b>		
(Based on typical performance of Transaqua HT & HT2, unless otherwise stated).		
Material	Compatibility	Comments
Mild Steel A105	Compatible	Unprotected carbon steel above the fluid surface may be subject to corrosion from condensed moisture.
Alloy Steel 4140	Compatible	
Alloy Steel 440C	Compatible	
Stainless Steel 316	Compatible	
Stainless Steel 17-4PH	Compatible	
Nitronic 60	Compatible	
Monel 400	Compatible	
Nickel 200	Compatible	
Inconel 825	Compatible	
Super Duplex 2507	Compatible	
Aluminium Bronze (CDA945)	Compatible	
Tungsten Carbide - 10% Cobalt Bonded	Compatible	This material had been used in both solid sintered form and as a spray coating. It has been widely recognised that some corrosion can take place with water based control fluids due to the leeching of the Cobalt binder. With sufficient component section size this is not an issue, but if components are small then some review of the suitability should be carried out. thin coatings are not recommended. The additions of Nickel and Chromium can greatly improve the compatibility.
Tungsten Carbide - 9% Nickel Bonded	Compatible	
Aluminium	Limited Compatibility	Components may be protected by hard anodizing. Avoid rubbing contact.
Electroless Nickel Plating	Compatible	Ensure even plating thickness. (Transaqua HT2-N tested).
Zinc and Cadmium Plating	Not Compatible	Commonly used on standard industrial hydraulic components. Will be removed over time by water based control fluids.

Castrol Transaqua HT2-N is considered compatible with many materials commonly used in the construction of modern production subsea control systems. As with any fluid a complete materials review should always be carried out before using Castrol Transaqua HT2-N.

## Metals to be avoided

The following metals are best avoided with all glycol water-based fluids: Aluminium, Cadmium, Magnesium and Zinc. For coating compatibility data please contact Castrol Offshore.

<b>Table 4</b>		
<b>Fluid - Castrol Transaqua HT2-N Elastomer and Plastic Compatibility</b> (Based on typical performance of Transaqua HT & HT2, unless otherwise stated).		
Material	Compatibility	Comments
Nitrile (NBR)	Compatible	Widely used as a standard seal material. Performance can vary according to grade.
Hydrogenated Nitrile (HNBR)	Compatible	Better high temperature performance than Nitrile. Not recommended for temperatures above 120°C.
Low Permeability Nitrile	Compatible	
Fluorocarbon (FKM-Viton)	Compatible	Performance can vary according to grade. Not recommended for temperatures above 90°C.
PTFE	Compatible	Very inert, and suitable for high temperature and pressure applications.
PEEK	Compatible	Very inert, and suitable for high temperature and pressure applications.
Perfluoroelastomer (FFKM-Chemraz)	Compatible	Suitable for extreme temperature applications. But can suffer from creep.
Polyurethane	Compatible	Good resistance to abrasion. Performance can vary with grade.
Ethylene Propylene (EPDM)	Compatible	Good compatibility with water based fluids, and at elevated temperatures. <b>Important</b> - EPR is not suitable for use with any hydrocarbon based fluids or greases.
Nylon 11	Compatible	Tested to API 17 E.
Silicone	Compatible	Poor mechanical properties, but wide temperature range.

The data reported in Table 4 above refer to "standard" compounds recognised by industry. However, performance can vary depending on manufacturer, grade or operational conditions, e.g. manufacturing process, filler materials used in compounds, application, extreme temperatures, etc. We therefore recommend clarification of further testing is sought regarding project specific material compatibility, from either the seal vendor or Castrol Offshore.

## Seal Materials to be Avoided

Rubber Impregnated Fabric Composites are not compatible with Castrol Transaqua HT2-N. These materials must be changed out from equipment to be used with Castrol Transaqua HT2-N.

## Painted and other Surface Coatings

It is recommended that in accordance with good working practice the internal surface of the hydraulic system should not be coated. However, external surfaces may require coating and as with all control fluids conventional paint systems will tend to soften or strip. It is therefore recommended that these be replaced by cured epoxy, nylon, or phenolic types as commonly used subsea. Surface preparation prior to paint application is critical.

Where it is necessary to use internal surface coatings such as PTFE these should be assessed for suitability of use. Manufacturers guidelines should be observed with regards cure times and temperatures and as with paints systems surface preparation specifications should be adhered to.

## Environmental Compliance

While Castrol Transaqua HT2-N is compliant with OSPAR legislation providing a large global footprint and meets Australian local species toxicity requirements, it is specifically designed for Norwegian legislative requirements for surface and subsea operations.

## Product Supply

Our products are available world-wide through our global sales and logistics network, with stocks held in all strategic offshore supply locations. All our subsea products are supplied in 208 litre (55 US gallon) plastic drums as well as bulk containers and small pack; for details of specific packaging availability in your location contact your local Castrol Offshore sales office.

## Storage

All packages should be stored under cover. Where outside storage is unavoidable drums should be laid horizontally to prevent the possible ingress of water and obliteration of drum markings. Product should not be stored above 60°C, exposed to hot sun or freezing conditions.

Transaqua HT2-N

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