

PRODUCT AND TECHNICAL DATA



Castrol Transaqua HC10 and HC20

Water-based subsea production control fluids for hydrate control

2007 OSPAR compliant with no substitutable components

Description

Castrol Transaqua HC10 and HC20 are water-based hydraulic control fluids specifically formulated for use as the control medium in surface and subsea production control systems, in high and ultra high pressure gas wells, where there is a risk of hydrate formation due to gas ingress. The fluids incorporate 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 HC10 and HC20 have been developed and qualified under a Quality Management System with ISO 9001:2000 certification for Research and Development and an Environmental Management System with ISO14001:2004 certification for Research and Development.

Qualification testing was carried out in accordance with ISO 13628-6 Annex C (2006 E).

Application

- Castrol Transaqua HC10 is suitable for high pressure projects (exceeding 10,000psi at 4°C) and HC20 is suitable for ultra high pressure projects (exceeding 20,000psi at 4°C), where entrained gas may contaminate control lines creating a risk of hydrate formation.
- Castrol Transaqua HC10 and HC20 are rated for operation over a temperature range of -50°C (-58°F) to 180°C (356°F).
- Castrol Transaqua HC10 and HC20 are tolerant of the high well temperatures encountered by those parts of the control system located at the well bore.
- The extremely 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 systems, 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.



Features

- Fully compliant with 2007 OSPAR environmental legislation and does not contain any “substitutable” components.
- Castrol Transaqua HC10 and HC20 utilise the same proven technology found in the field-proven Castrol Transaqua HT and HT2.
- Similar performance to Castrol Transaqua HT and HT2 with an operating capability up to 180°C (356°F). See Table 1, Table 2, & Table 3 for detailed physical and performance characteristics.
- Castrol Transaqua HC10 and HC20 contain a yellow metal passivator.
- Castrol Transaqua HC10 and HC20 contain a unique tracer to aid low-level Subsea leak detection.
- Castrol Transaqua HC10 and HC20 are fully compatible and miscible in all proportions with the Castrol Transaqua range and most other water-based subsea control fluids.
- As with all glycol based control fluids, Castrol Transaqua HC10 and HC20 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 HC10 and HC20 by either of these types of products can seriously affect the product performance.
- Castrol Transaqua HC10 and HC20 are resistant to bacterial and fungal growth.
- Castrol Transaqua HC10 and HC20 are stable with seawater contamination.
- Castrol Transaqua HC10 and HC20 are compatible with a wide range of materials commonly used in subsea control systems, for basic lists see Table 4 & Table 5.

Benefits

- Proven track record of Castrol Transaqua series chemistry.
- Compliance with 2007 OSPAR environmental legislation provides a large global operational footprint.
- Allows reliable operation of subsea equipment exposed to conventional or HP/HT conditions.
- Allows rapid detection of leaks either visually or using a dedicated ROV mountable leak detection tool.
- Compatibility and miscibility properties of Castrol Transaqua HC10 and HC20 with other water based control fluids allow for easily managed direct top up and upgrade option programs. For further details contact Castrol Offshore.
- The chemistry of the fluids is optimized to allow operation in extremely low ambient temperature environments and specifically inhibit hydrate formation. Castrol Transaqua HC10 and HC20 ensure reliable operation through prevention of hydrate formation in high and ultra high pressure control lines respectively and therefore provide reliable operation of subsea equipment.
- Viscosity profile of fluids permits optimum hydraulic response through long control umbilicals.

Table 1

Fluid - Castrol Transaqua HC10 and HC20										
Rheology @ ambient pressure										
Temperature	Castrol Transaqua HC10					Castrol Transaqua HC20				
	Density		Kinematic Viscosity	Bulk Modulus		Density		Kinematic Viscosity	Bulk Modulus	
	°C (°F)	g/ml	lb/ft ³	cSt	N/m ² (x10 ⁹)	psi (x10 ⁵)	g/ml	lb/ft ³	cSt	N/m ² (x10 ⁹)
-25 (13)	1.0993	68.63	32.6	2.94	4.27	1.1096	69.27	43.6	3.05	4.43
0 (32)	1.0847	67.72	12.4	2.85	4.13	1.0935	68.26	14.6	2.90	4.21
20 (68)	1.0730	66.99	8.0	2.75	3.99	1.0806	67.46	9.1	2.77	4.03
40 (104)	1.0613	66.25	5.6	2.64	3.83	1.0677	66.65	6.1	2.64	3.83
100 (212)	1.0262	64.06	2.9	2.21	3.21	1.0290	64.24	3.0	2.20	3.19
175 (347)	0.9824	61.33	2.0	1.49	2.16	0.9807	61.22	2.0	1.54	2.24

Table 2

Fluid - Castrol Transaqua HC10 and HC20				
General Properties				
Property	Code	Units	HC10 Typical Values	HC20 Typical Values
Appearance	-	-	Clear mobile liquid	Clear mobile liquid
Colour	-	-	Pale straw	Pale straw
Pour Point	IP15 / ASTM D97	°C (°F)	-60 (-76)*	-60 (-76)*
Flash Point	ASTM D92	°C (°F)	N/A as water based	N/A as water based
pH @ 20°C (68°F)	-	-	8.9	8.9
TAN	IP177 / ASTM D664	mg KOH/g	3.4	3.4
TBN	IP276 / ASTM D2896	mg KOH/g	17.3	17.3
Coefficient of Thermal Expansion	-	m ³ /m ³ °C	0.00054	0.00059
Thermal Conductivity	ASTM D2717	W/m°C	0.42	0.42
Specific Heat	ASTM D2766	KJ/Kg/K	3.257	3.257
Foam Test Sequence 1 Tendency	IP146 / ASTM D892	ml	300	300
Foam Test Sequence 1 Stability	IP146 / ASTM D892	ml	0	0
Viscosity Index (VI)	ASTM D2270	-	N/A as water based	N/A as water based
Moisture Content Volumetric-Karl Fisher	IP386	p.p.m	N/A as water based	N/A as water based
Relative Humidity	CWS01	%	N/A as water based	N/A as water based
Particulate Cleanliness	SAE AS4059E	-	Class 6 B to F or better	Class 6 B to F or better
	ISO 4406	-	Code 14/11 or better	Code 14/11 or better

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

* Pour point reading of -60°C (-76°F) is the limitation of the test equipment.

Table 3

Fluid - Castrol Transaqua HC10 and HC 20 Typical Performance Characteristics		
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)	Sterile during and after test
Lubrication Shell 4 Ball – Mean Wear Scar Diameter (1hr, 30 kg, 1460 rpm)	IP239	0.912 mm (HC10) 0.921 mm (HC20)
Environmental Performance	2007 OSPAR Guidelines	Meets 2007 OSPAR requirements - all components tested for toxicity (4 species), biodegradation and bioaccumulation.
Compatibility	Metals	ISO 13628-6 Annex C (2006 E)
	Elastomers / Plastics	ISO 13628-6 Annex C (2006 E)
	Umbilical Testing	API 17E
Valve Testing	DCV	OEM specific
	SSSV	OEM specific & OTO99001

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

Hydrate Inhibition Characteristics

Methane hydrate dissociation curves for Castrol Transaqua HC10 and HC20 have been generated by laboratory testing at Herriot-Watt University, see Figure 1. These Curves are compared against curves for HT/HT2 and a typical competitor grade also generated by Herriot-Watt University. Figure 2 details a schematic of the equilibrium test set up and shows a photograph of the rig used.

It is important to define the following factors to assure that Castrol Transaqua HC10 and HC20 will prevent hydrate formation in specific project conditions.

- Clearly defining control system low temperature and high pressure conditions
- The likely gas composition as different gas compositions will affect the hydrate risk profile
- Quantify the volume and impact of seawater contamination in HP coupler.
- Selecting the control fluid / safety margin requirements for a given set of conditions.

For further advice on how to proceed with control fluid hydrate inhibition for a specific project, please contact Castrol Offshore.

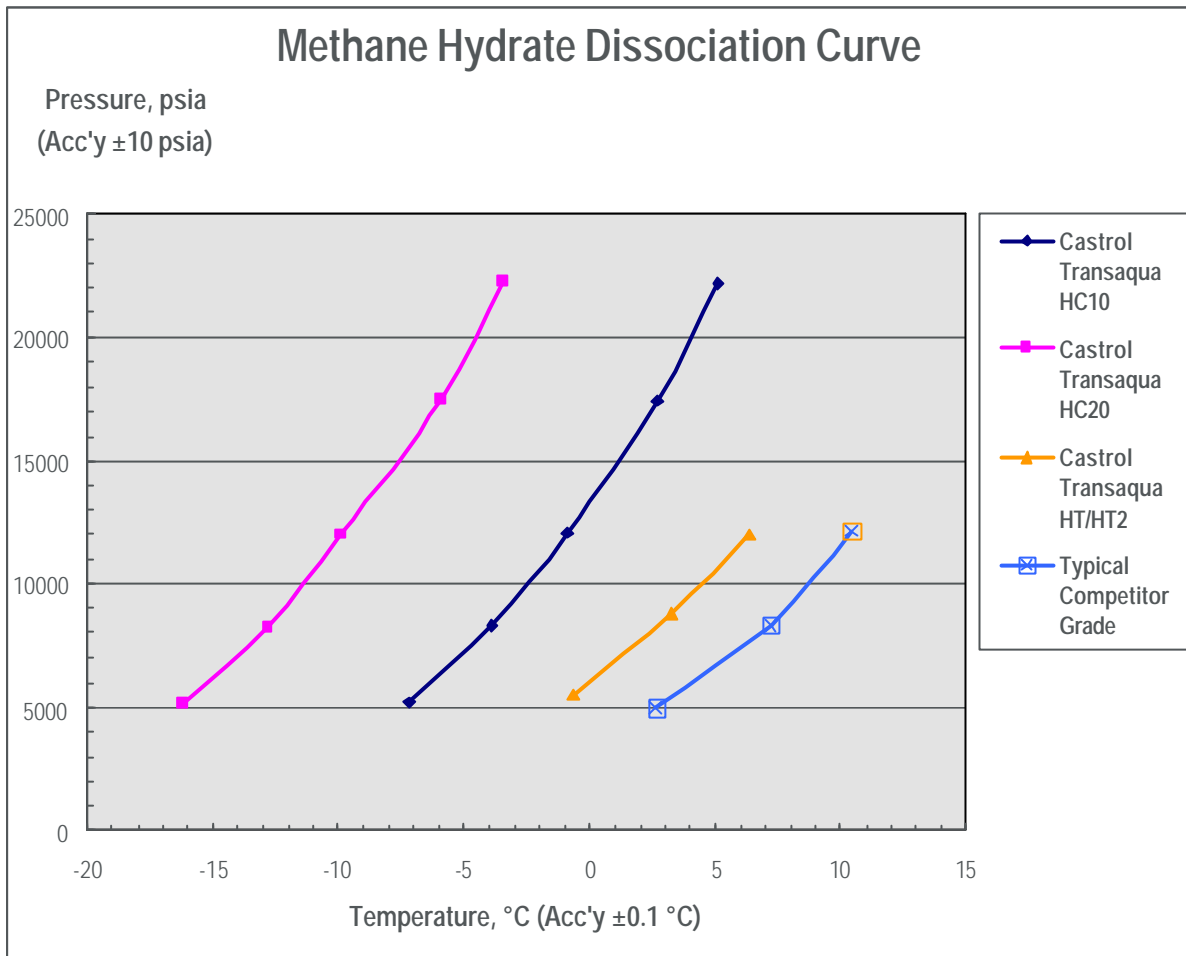


Figure 1 - Methane hydrate dissociation curve for Castrol Transaqua grades and a typical competitor grade of control fluid

Note: The lower two values on the HC10 curve were generated by extrapolation rather than experimentation.

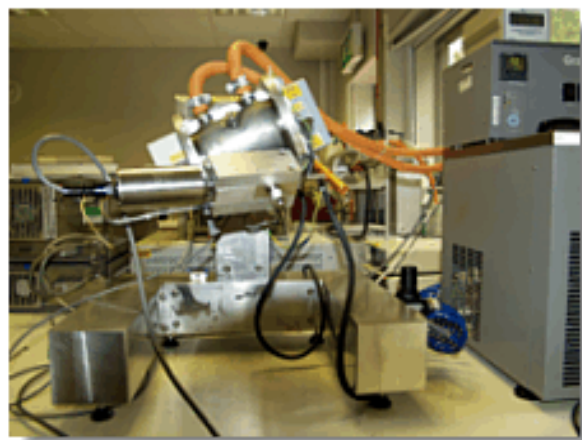
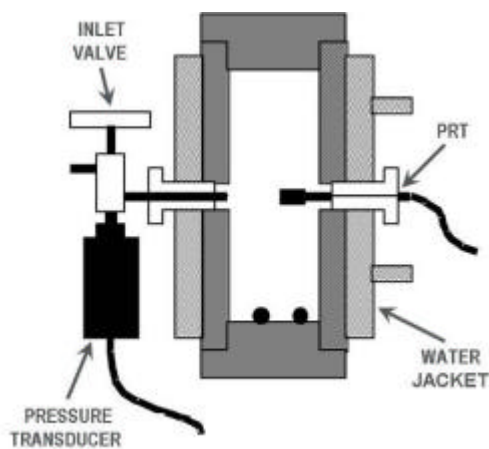


Figure 2 - Schematic illustration of the equilibrium cell (not to scale) and a picture of the hydrate equilibrium rig used during this scope of work.

Table 4

Fluid - Castrol Transaqua HC10 and HC20 Metal compatibility		
Material	Compatibility	Comments
<i>Mild Steel A105</i>	Compatible	Unprotected carbon steel above the fluid surface may be subject to corrosion from condensed moisture.
<i>Alloy Steel 4140</i>	Compatible	
<i>Alloy Steel 440C</i>	Compatible	
<i>Stainless Steel 316</i>	Compatible	
<i>Stainless Steel 17-4PH</i>	Compatible	
<i>Nitronic 60</i>	Compatible	
<i>Monel 400</i>	Compatible	
<i>Nickel 200</i>	Compatible	
<i>Inconel 825</i>	Compatible	
<i>Super Duplex 2507</i>	Compatible	
<i>Aluminium Bronze (CDA945)</i>	Compatible	
<i>Tungsten Carbide - 10% Cobalt Bonded</i>	Compatible	
<i>Tungsten Carbide - 9% Nickel Bonded</i>	Compatible	
<i>Aluminium</i>	Limited compatibility	Components may be protected by hard anodizing. Avoid rubbing contact.
<i>Electroless Nickel Plating</i>	Compatible	Ensure even plating thickness.
<i>Zinc and Cadmium Plating</i>	Not compatible	Commonly used on standard industrial hydraulic components. Will be removed over time by water based control fluids.

Castrol Transaqua HC10 and HC20 are 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 HC10 or HC20.

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.

Table 5

Fluid - Castrol Transaqua HC10 and HC20 Elastomer & Plastic compatibility		
Material	Compatibility	Comments
<i>Nitrile (NBR)</i>	Compatible	Widely used as standard seal material. Performance can vary according to grade.
<i>Hydrogenated Nitrile (HNBR)</i>	Compatible	Better high temperature performance than Nitrile. Not recommended for temperatures above 120°C.
<i>Low permeability Nitrile</i>	Compatible	
<i>Fluorocarbon (FKM - Viton)</i>	Compatible	Performance can vary according to grade. Not recommended for temperatures above 90°C.
<i>PTFE</i>	Compatible	Very inert, and suitable for high temperature and pressure applications.
<i>PEEK</i>	Compatible	Very inert, and suitable for high temperature and pressure applications.
<i>Perfluoroelastomer (FFKM - Chemraz)</i>	Compatible	Suitable for extreme temperature applications. But can suffer from creep.
<i>Polyurethane</i>	Compatible	Good resistance to abrasion. Performance can vary with grade.
<i>Ethylene Propylene (EPDM)</i>	Compatible	Good compatibility with water based fluids, and at elevated temperatures. Important - EPR is not suitable for use with any hydrocarbon based fluids or greases.
<i>Nylon 11</i>	Compatible	Tested to API 17 E for 3 months @ 70°C.
<i>Silicone</i>	Compatible	Poor mechanical properties, but wide temperature range.

As with all elastomer compatibility testing, performance of materials can vary between manufacturers. The data reported above refer to "standard" compounds recognised by industry. In critical applications it is advisable to carry out additional testing on specific materials obtained from the component manufacturer.



Seal Materials to be avoided

Rubber Impregnated Fabric Composites are not compatible with Castrol Transaqua HC10 or HC20. These materials must be changed out from equipment to be used with Castrol Transaqua HC10 or HC20.

Paint 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

Castrol Transaqua HC10 and HC20 are compliant with 2007 OSPAR legislation providing a large global operational footprint. For more detailed information on environmental compliance contact Castrol Offshore.

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 packs; 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 avoid ingress of water and the possible obliteration of drum markings. Product should not be stored above 60°C, exposed to direct hot sun or freezing conditions.



Health and Safety

The wearing of impervious PVC (or other suitable material) apron and gloves, together with eye protection is recommended. Contaminated clothing should be changed immediately and thoroughly cleansed before re-use. This applies especially to under garments.

Material safety data sheets are available for all Castrol subsea products from www.subseadownloads.castrol.com

Or by contacting the addresses or website below.

Disclaimer

Data reported in this datasheet are the result of work carried out in Castrol and other laboratories, and is believed to be accurate. Specific values are typical for the product, but must not be considered as constituting a specification.

Data included may be subject to revision, and additional data may be periodically added. Before using data in critical application, recipients are advised to consult Castrol Offshore at addresses below.

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SYSTEM RELIABILITY

It must work: designing out all foreseeable early life and through life failures.

ENVIRONMENTAL LEADERSHIP

Minimise environmental impact: preventing, reducing or eliminating pollution from subsea operations.

GLOBAL SERVICE AND SUPPORT

Service excellence: we develop proactive, responsive and open relationships.

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