Product Data

Transaqua™ HC Range

Water-based subsea production control fluid

Description

Castrol Transaqua™ HC 10 and HC 20 are water-based hydraulic control fluids specifically formulated for use as the control medium in subsea production control systems and 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 throughout the control system including Sub Surface Safety Valves (SSSV) and intelligent well completions.

Transaqua HC 10 and HC 20 have 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.

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

Application

- Transaqua HC 10 is suitable for high pressure projects (exceeding 10,000 psi at 4ºC) and Transaqua HC 20 is suitable for ultra high pressure projects (exceeding 20,000 psi at 4ºC), where entrained gas may contaminate control lines creating a risk of hydrate formation.
- Can operate over a temperature range of -50ºC (-58ºF) to 170ºC (338ºF).
- Passed ISO 13628-6 Annex C (2006 E)/API 17F TR8 testing at 170°C (338°F)
- Track record of use in subsea production control systems at tempertures up to 170°C (338°F)
- Tested to 180°C (356°F) in SSSV Equipment to OTO 99 001
- Suitable for use within Electro-Hydraulic Multiplex (EH-Mux) or direct hydraulic control systems.
- Designed for 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.

Advantages

- Transaqua HC10 and HC 20 have been tested according to OSPAR requirements. Transaqua HC 10 is registered for use offshore in the UK. Rigorous environmental testing has also been completed in many geographies worldwide.
- Transaqua HC 10 and HC 20 utilise the same technology found in the field proven Transaqua HT2.
- Allow operation in extremely low ambient temperature environments and specifically inhibit hydrate formation in high and ultra high pressure control lines.
- Contains a leak tracer to allow rapid detection of leaks either visually or using dedicated ROV mountable leak detection sensor.
- Maintains corrosion performance with seawater contamination.
- Tolerant of the high well temperatures encountered by those parts of the control system located at the well bore.
- Fully compatible and miscible in all proportions with other products in the Castrol Transaqua range and most other water-based subsea control fluids.
- Compatible with a wide range of materials commonly used in subsea control systems (see Tables 4 & 5). More detailed compatibility information is available on request.

Typical Physical Characteristics

Table 1

Fluid - Castrol Transaqua HC 10 and HC 20
Rheology @ Ambient Pressure

	Castrol Transaqua HC 10					Castrol Transaqua HC 20				
Temperature	Density		Kinematic Viscosity	Bulk Modulus		Density		Kinematic Viscosity	Bulk Modulus	
ºC (ºF)	g/ml	lb/ft³	mm²/s	N/m² ($x10^9$)	psi ($x10^5$)	g/ml	lb/ft³	mm²/s	N/m² ($x10^9$)	psi ($x10^5$)
-25 (13)	1.0993	68.63	64.40	2.94	4.27	1.1096	69.27	78.54	3.05	4.43
0 (32)	1.0847	67.72	11.86	2.85	4.13	1.0935	68.26	13.56	2.90	4.21
20 (68)	1.0730	66.99	4.97	2.75	3.99	1.0806	67.46	5.89	2.78	4.03
40 (104)	1.0613	66.25	2.65	2.64	3.83	1.0677	66.65	3.31	2.64	3.83
100 (212)	1.0262	64.06	0.84	2.21	3.21	1.0290	64.24	1.23	2.20	3.19
175 (347)	0.9824	61.33	0.41	1.49	2.16	0.9807	61.22	0.68	1.54	2.24

Table 2

Fluid - Castrol Transaqua HC 10 and HC 20
General Properties

Property	Code	Units	HC 10 Typical Values	HC 20 Typical Values
Appearance			Clear mobile fluid	Clear mobile fluid
Colour			Pale straw	Pale straw
Pour Point	ISO 3016 / ASTM D97	ºC (ºF)	-60 (-76)*	-60 (-76)*
Flash Point - open cup method	ISO 2592 / ASTM D92	ºC (ºF)	N/A as water based	N/A as water based
pH at 20ºC (68ºF)			8.9	8.9
Acid Number	ISO 6619 / ASTM D664	mg KOH/g	3.4	3.4
Base Number	ISO 3771 / ASTM D2896	mg KOH/g	17.3	17.3
Coefficient of Thermal Expansion	ASTM D1903	$ºC^{-1}$	0.00054	0.00059
Thermal Conductivity	ASTM D2717	W/mºC	0.42	0.42
Specific Heat	ASTM D2766	kJ/Kg°C	3.257	3.257
Foam Sequence 1-tendency/stability	ISO 6247 / ASTM D892	ml / ml	300 / 0	300 / 0
Particulate Cleanliness	SAE AS4059F		Class 6	Class 6

The above figures are typical of those obtained with normal production tolerance and do not constitute a specification.
Detailed Pressure/Viscosity/Temperature (PVT) data available on request.
* Pour point reading of -60ºC (-76ºF) is the limitation of the test equipment.

Table 3			
Fluid - Castrol Transaqua HC 10 and HC 20 Typical performance Characteristics			
Property		Code	Performance
Seawater Stability		ISO 13628-6 Annex C (2006 E)	Stable with up to 10% seawater contamination. Provides anti corrosion performance on carbon steel with up to 10% seawater.
Lubrication Shell 4 Ball - Mean Wear Scar Diameter (1hr, 30kg, 1460 rpm)		IP239	0.912 mm (HC 10) 0.921 mm (HC 20).
Environmental Performance		OSPAR Requirements	Tested according to OSPAR requirements - all components tested for toxicity (4 species), biodegradation and bioaccumulation.
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 4.
	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 5.
	Umbilical Testing	API 17E	3 month compatibility testing completed successfully.*
Valve Testing	DCV	OEM specific	Qualified by a number of leading DCV manufacturers.*
	SSSV	OEM specific & OTO99001	Qualified by a number of leading SSSV manufacturers.*

* For performance testing with Transaqua HC 10 contact Castrol.

Hydrate Inhibition Characteristics

Methane hydrate dissociation curves for Castrol Transaqua HC 10 and HC 20 have been generated by laboratory testing at Herriot-Watt University, see Figure 1. These curves are compared against curves for Transaqua 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 photo of the rig used.

It is important to define the following factors to assure that Castrol Transaqua HC 10 and HC 20 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.

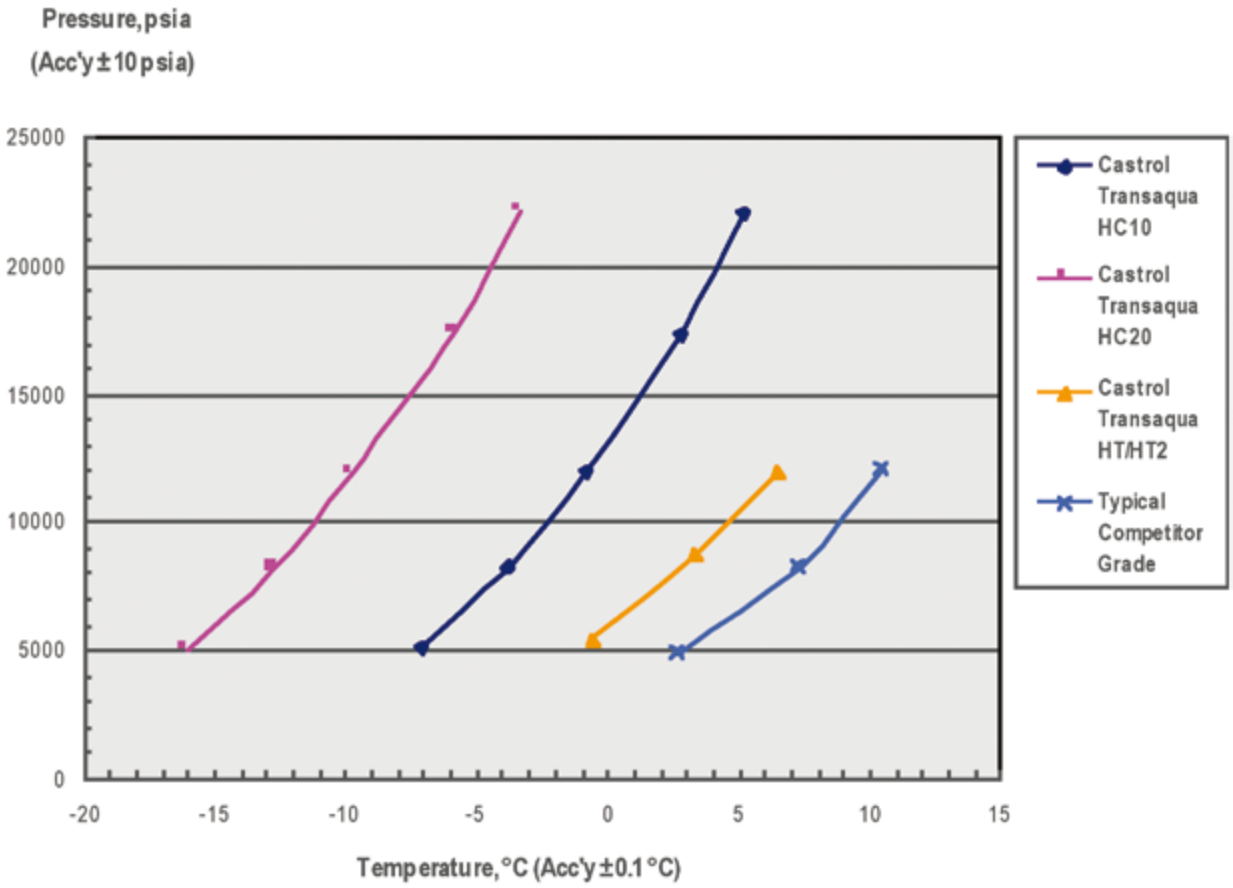

Figure 1 - Methane hydrate dissociation curve for Castrol Transaqua grades and a typical competitor grade of control fluid.
Note: The lower two values on the HC 10 curve were generated by extrapolation rather than experimentation.

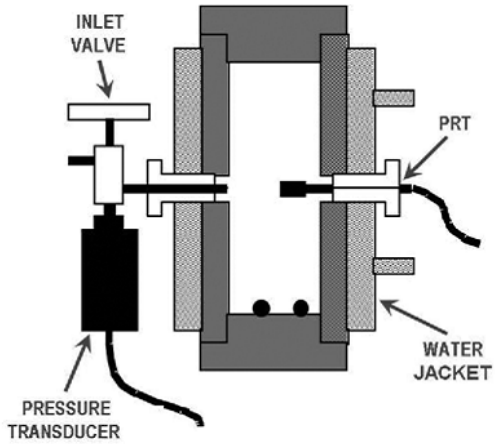

Figure 2 - Schematic illustration of the equilibrium cell (not to scale) and a picture of the hydrate equilibrium rig used.

Table 4

Fluid - Castrol Transaqua HC 10 and HC 20
Metal Compatibility

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.
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 HC 10 and HC 20 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 HC 10 or HC 20.

Metals to be Avoided

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

Table 5		
Fluid - Castrol Transaqua HC 10 and HC 20 Elastomer and Plastic Compatibility		
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 120ºC.
Low Permeability Nitrile	Compatible	
Fluorocarbon (FKM-Viton)	Compatible	Performance can very according to grade. Not recommended for temperatures above 90ºC.
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. **Important** 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 5 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 or further testing is sought regarding project specific material compatibility, from either the seal vendor or Castrol.

Seal Materials to be Avoided

Rubber Impregnated Fabric Composites are not compatible with Castrol Transaqua HC 10 or HC 20. These materials must be changed out from equipment to be used with Castrol Transaqua HC 10 or HC 20.

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.

Care and Handling

This product has been manufactured to a tightly controlled cleanliness specification. Any container that has been opened for use must be re-sealed to avoid contamination ingress from the environment (eg particulates or water). Any contaminants entering the product can affect its performance. The integrity of the product once the container is opened is the responsibility of the end user. It is good practice to use tarpaulins or drum lids to cover all containers to prevent ingress of contamination.

As with all glycol based control fluids, Castrol Transaqua HC 10 & 20 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 HC 10 & 20 by either of these types of products can seriously affect the product performance.

If you need advice on any of the above, please contact your local Castrol Technical Service Engineer for more specific details.

Storage

All containers should be stored under cover and protected from exposure to direct sunlight. Do not store containers in temperatures below minus 5ºC or above 45°C. 208L plastic drums can be stored a maximum of 2 high, providing a pallet is used to distribute the upper load evenly. In addition, the fill level of the upper drums should be less than or equal to the fill level of the lower drums. It is not recommended to store 208L plastic drums horizontally.

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