

出國報告（出國類別：洽公）

配合 105 年四萬噸級成品油輪汰換計畫
A10101 新船交船之貨油泵裝備檢驗及測
試報告

服務機關：台灣中油股份有限公司

姓名職稱：黃戊辰 組長

派赴國家：挪威

出國期間：105 年 3 月 4 日至 11 日

報告日期：105 年 3 月 21 日

摘要

本公司新建環(離)島 40,000 DWT 成品油品輪鴻運及盛運輸預計於 2016 年交船，為執行四萬噸級環島成品油輪建造專案計畫，為確認主要裝備的性能能滿足規範要求，於出廠前進行出廠性能測試(FACTORY ACCEPTANCE TEST, FAT)。。

本次測試之裝備為為兩艘成品油輪貨油系統的貨油泵，總計 30 部貨油泵(Cargo Pump, 24 部 SD200、4 部 SD150 及 2 部 TK100)，於裝備供應商(Frank Mohn AS 公司)位於挪威卑爾根的製造工廠進行。

此次出國主要任務為參加製造工廠裝備出廠前測試，包括 主貨油泵、SLOP TANK 貨油泵及緊急貨油泵裝置運轉 及性能測試及外觀完整性檢查等，以確認裝備性能可達到設計目標。

經兩天運轉測試，初步測試以及最後之討論，結果確認所有貨油泵性能符合原廠所提供之性能測試標準，後續尚須等最終船上安裝、配合之前已經測試之油壓動力單元進行調校 及船上運轉測試等，以確保未來營運期間系統正常運轉。

本次測試自 2016 年 3 月 4 至 2016 年 3 月 11 日止，共計 7 天，含交通往返。

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配合 105 年四萬噸級成品油輪汰換計畫 A10101 新船交船之貨油泵裝備檢驗及測試報告

一 目的

為淘汰本公司兩艘船齡已接近 25 年的四萬噸級成品油輪「安運」、「康運」，滿足 104 年以後國內油品充分供應之需求，於 102 年 6 月 23 日與台船公司簽約辦理 A10101 計畫新建兩艘 4 萬噸級成品油輪(建造船號為 1053 及 1054)，預定於 105 年 12 月交船。

執行新建環(離)島 40,000 DWT 成品油輪鴻運(1053)及盛運輪 1054)，為配合兩艘新船建造期程，並確認主要裝備的性能可符合滿足本船所需，故於出廠前進行出廠性能測試(FACTORY ACCEPTANCE TEST, FAT)，本項測試主要目的在製造工廠，裝備在控制環境下進行全負荷測試，以確認實際性能可達到原設計目的。以確保未來在船上安裝後能夠滿足實際作業需求。為確認主要裝備的性能能滿足規範要求，於出廠前進行出廠性能測試(FACTORY ACCEPTANCE TEST, FAT)。

本次測試之裝備為兩艘成品油輪貨油系統的貨油泵，總計 30 部貨油泵(Cargo Pump, 24 部 SD200、4 部 SD150 及 2 部 TK100)，於裝備供應商(Frank Mohn AS 公司)位於挪威卑爾根的製造工廠進行。

此次出國主要任務為參加製造工廠裝備出廠前測試，包括主貨油泵、SLOP TANK 貨油泵及緊急貨油泵裝置運轉及性能測試及外觀完整性檢查等，以確認裝備性能可達到設計目標。

經兩天運轉測試，初步測試以及最後之討論，結果確認所有貨油泵性能符合原廠所提供之性能測試標準，後續尚須等最終船上安裝、配合之前已經測試之油壓動力單元進行調校及船上運轉測試等，以確保未來營運期間系統正常運轉。

二 行程

(一) 出國行程

預定起迄日期	到達地點	工作內容
105 年 3 月 5 日	台北/ 荷蘭阿姆斯特丹	去程
105 年 3 月 6 日	抵達荷蘭阿姆斯特丹 轉機至挪威卑耳根機場	去程
105 年 3 月 7 日	FRAMO 工廠	1. 安全會議及測試程序介紹 2. 開始貨油泵浦測試 3. 檢查量測儀器之校正紀錄 並與現場裝備核對證書號碼與設備編號
105 年 3 月 8 日	FRAMO 工廠	1. 繼續貨油泵浦性能測試 2. 工廠參觀

105年3月9日	FRAMO 工廠	1. 性能測試結果討論 2. 測試報告確認
105年3月10-11日	挪威杯耳根轉荷蘭阿姆斯特丹再轉飛回台北	回程

(二) 參加人員

1. 廠商(Frank Mohn AS 公司)代表:
 專案經理：Mr.Bengt Holme
 專案工程師：Mr.Magnus Hlmefjord
 測試工程師: Mr.N.A. Necl
 Framo Shanghai: Mr. Colin S.P. Man
2. 船東：中油儲運處海技組組長黃戊辰組長
3. 中油委託技術服務廠商：財團法人聯合船舶設計發展中心艙裝組 程心華 工程師

(三) 廠試標的

1. 名稱：主貨油泵
 - A. 數量：共24部(每船12部)
 - B. 型號：SD200-6 DTHH200-C347
 - C. 額定容量：600m³/h @specific gravity 0.8kg/dm³.
 測試容量：570m³/h @specific gravity 1.0kg/dm³.
 - D. Discharge Head: 125mwc
 Test Discharge Head: 100mwc
 - E. Hydraulic Oil Flow: 570 l/min
 Test Hydraulic Oil Flow: 510 l/min
 - F. Hydraulic Oil Pressure: 255bar
 Test Hydraulic Oil Pressure: 255bar
2. 名稱：SLOP貨油泵
 - A. 數量：共4部(每船2部)
 - B. 型號：SD150-6 DTHH107-B315
 - C. 額定容量：300m³/h @specific gravity 0.8kg/dm³.
 測試容量：268m³/h @specific gravity 1.0kg/dm³.
 - D. Discharge Head: 125mwc
 Test Discharge Head: 100 mwc

- E. Hydraulic Oil Flow: 570 l/min
Test Hydraulic Oil Flow: 510 l/min
- F. Hydraulic Oil Pressure: 255 bar
Test Hydraulic Oil Pressure: 255 bar

3. 名稱：緊急貨油泵

- A. 數量：共2部(每船1部)
- B. 型號：TK100-6 DUHH32-A178
- C. 額定容量：150m³/h @specific gravity 0.8kg/dm³.
測試容量：150m³/h @specific gravity 1.0kg/dm³.
- D. Discharge Head: 70mwc
Test Discharge Head: 70 mwc
- E. Hydraulic Oil Flow: 145 l/min
Test Hydraulic Oil Flow: 145 l/min

- 4. Hydraulic Oil Pressure: 194 bar
Test Hydraulic Oil Pressure: 230 bar

(四) 廠試過程

1. 廠試前溝通會議

105年3月7日上午0830抵達Framo 位於Fusa 工廠，由該廠 Project Manager Mr. Bengt Holme主持起始會議，品保主管及原廠代理(上海與台灣代表)介紹訪客安全注意事項後，由專案工程師：Mr.Magnus Hlmefjord 介紹測試流程及測試內容。經雙方確認後，更換安全鞋後至測試工場開始進行測試。



廠試前溝通會議



測試現場佈置介紹

2. 廠試經過

抵達測試工場後，先由測試工程師介紹現場佈置，相關 測試裝備及測試機組等並進形外觀檢查並核對測試泵浦裝備序號後開始進行運轉測試，為使測試能夠順利展開，事前同意先做暖機之低速運轉。

依據測式程序，首日進行12部主貨油泵及4部SLOP貨油泵與2部緊急貨油泵之運

轉測試，每部泵浦測試前需經過15分鐘之低速運轉，主要之測試方法為依據事先設定之流量及DISCHARGE HEAD，當達到設定標準時，紀錄油壓泵浦液壓油消耗量及液壓油壓力與回油壓力是否符合測試標準，以本次測試而言液壓油之流量略低於設定值，而液壓油壓力略高於設定值，本套貨油系統依據液壓動力系統所能提供之液壓油流量，可以提供6部貨油泵浦同時運轉。



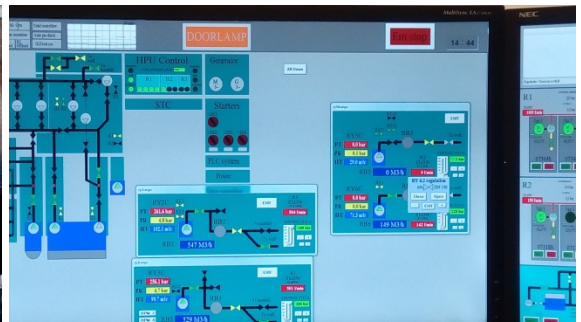
貨油泵測試前準備(液壓泵添加液壓油)



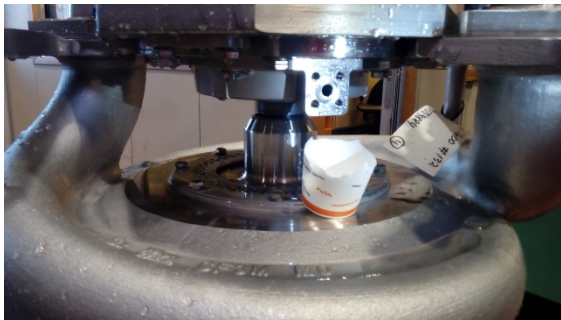
貨油泵組裝(吊入測試水池中)



貨油泵組裝完成(安裝於測試水池)



電腦監控貨油泵測試狀態及數據讀取



貨油泵測試完成後，確認機械軸封狀況



貨油泵測試完成後將泵內液壓油釋放

另外在每船測試最後一部貨油泵時會將出口閥關閉，使泵浦泵量歸零，然後紀錄DISCHARGE HEAD及液壓油泵量。

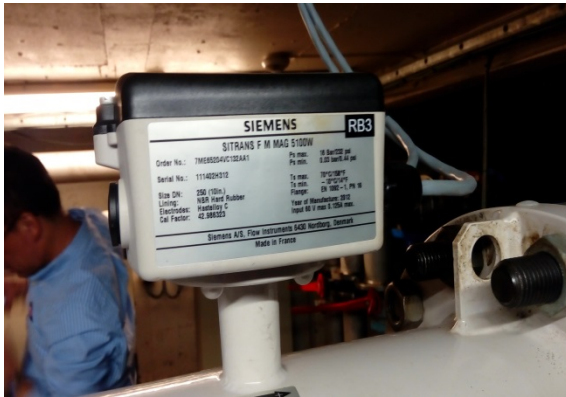
本次測試用到第2, 3, 5, 6號管線，每個管線上有5個監測點，在測試的過程中，要求FRAMO將相關之量測設備校正證書提供確認及核對，以確保所量測之數據的可靠性，每張證書均逐一核對現場之裝備，確認無誤。



液壓油流量計SENSOR



液壓油及回油壓力與輸出水頭SENSOR



貨油泵輸出流量計SENSOR

之後就測試過程及記錄等進行討論確認，由於FRAMO之紀錄僅有CARGO PUMP SERIES NO，因此要求必須將HYD. MOTOR的SERIES NO一併列入紀錄，完成第一日測試。 第二日依照第一日程序進行剩下之貨油泵。

3. 工廠參觀

這次測試主要在FRAMO FUSA工廠，所以僅能在測試之工廠內參觀，由於工廠內除了測試地點外，不能拍照，所以無法做詳細之介紹，且由於時間限制，每次之時間為換裝貨泵及暖機之時間，約15-20分鐘，只能走馬看花，但從整體之感覺上，偌大之工廠並無太多之工作人員，且大多數之人員僅是監控及操作設備，並無太多之工作，可見自動化之程度相當的高，一方面可以減少人工所造成之失誤，一方面提供工作效率。

4. 結束會議

就兩日測試結果核對是否與原設計性能標準相符，確認最終測試報告內容 請由參與人員簽署確認，完成此次測試。

三 心得及建議

1. 本次赴 FRAMO 參加出廠前測試，為第一次參加此類裝備測試。測試的目的是透過在設定之測試環境下，確認裝備性能符合設計要求，以確保安裝上船測試時，可能因實際環境限制而無法精準量測項目。為達到此目的，除在測試時確認結果外，在測試前即需先確認相關測試所需相關資訊，如依據標準，測試程序方法，測試要求結果等都應充分了解，可使測試更有效率。
2. 對於測試時裝備之量測儀器正確與否，將會決定整個測試結果之正確性，所以

對於裝備測試儀器之校正報告之核對，係非常重要之細節，除核對報告之號碼外，也要至現場核對確認現場裝備與證書也是一致的。

3. 本計畫兩艘成品油輪的貨油泵系統採用液壓潛式(SUBMERGE)系統，主要考量整體的可靠性較長軸型深井泵(DEEP WELL)為高。要維持液壓油的純淨度為使用本系統的重要課題，FRAMO 為避免因市場上一般管件工程輕忽的管路品質對液壓系統的影響，特別要求施工船廠需按照該公司之要求製作，且相關管系及屬件完全由該公司自行生產供應，少部分必需配合現場空間現場施作項目也由該公司提供必要組件並由船廠依照 FRAMO 的施工標準施工，以確保品質。
4. 測試過程中，FRAMO 所提供之裝備經過特別之設計，所以在結束一組泵浦之測試後，三個人可以在 10 分鐘之內更換完畢，可以說相當快速的完成更換，使得整個進度有略為超前及順利，說明工欲善其事，必先利其器知道理。
5. 在測試暖機之空檔有安排順便參觀 FRAMO FUSA 工廠之其他單位，除了自動化程度非常高之外，似乎工作人員並無太多之工作，只是監視機械設備之運作正常與否，所以人員不會很多。

四 附件

- (一) FAT Schedule for performance test of cargo pumps.
- (二) Certificate of calibration for pressure transmitter, oilflow turbinemeter and Magflo Vertificator.
- (三) Test protocol for standard hydraulically driven pumps.

FAT schedule for performance test of cargo pumps

Week 10 - 2016

CSBS Corp / CPC. Taiwan.

Order: 617600/601

HNo: 1053 /1054

Monday, 07.03.2016

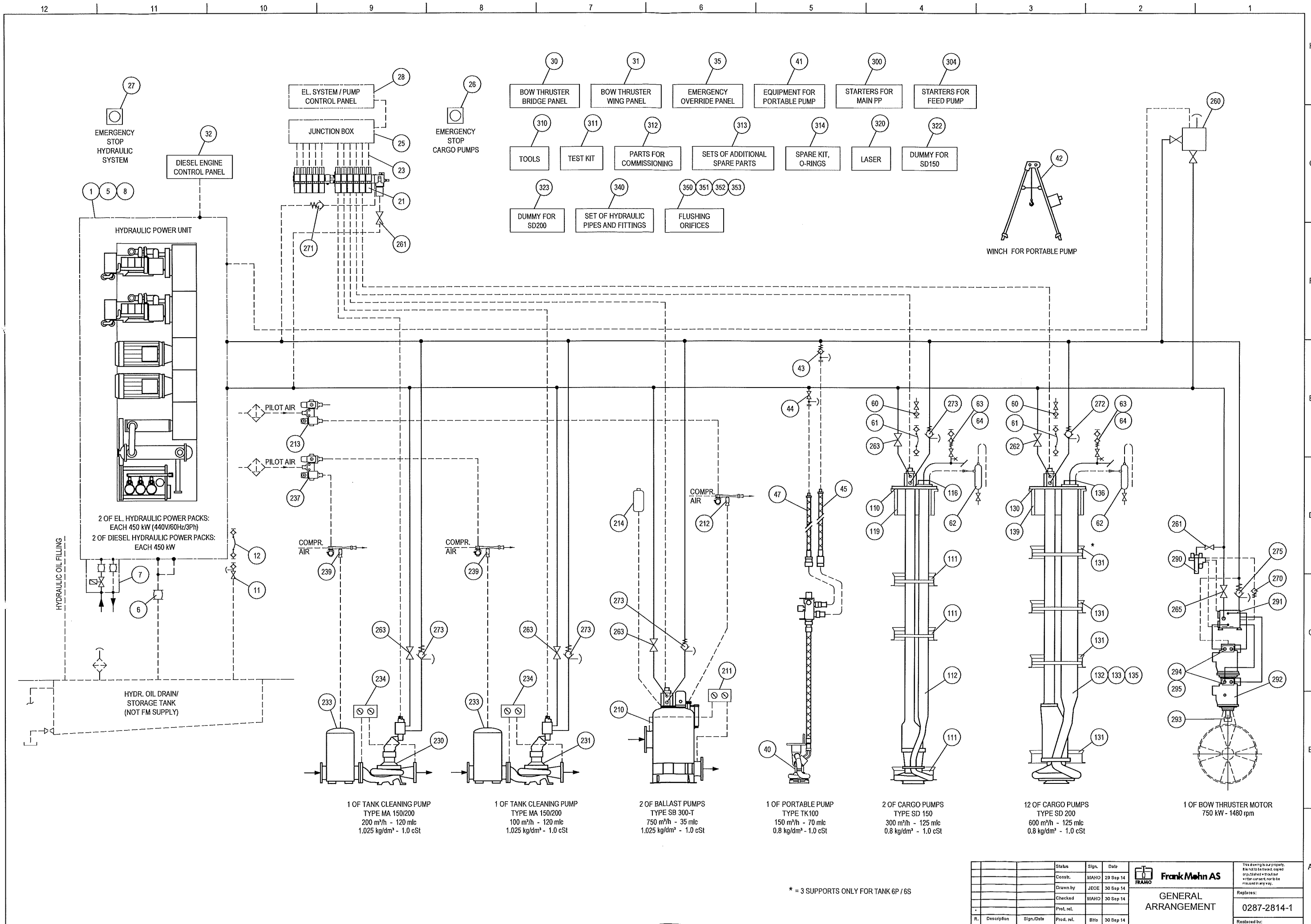
(Ferry from Hatvik to Venjanaset 08:20)

- 08:40 – 09:00. Safety briefing and short run-through of test procedure.
- 09:00 – 09:30. Test of 2 SD 200 and 1 SD 150 Cargo Pump. (warm up before arrival) ✓
- 10:00 – 11:00. Test of 2 SD 200 and 1 SD 150 Cargo Pump. ✓
- 11:00 – 11:30. Lunch.
- 12:00 – 13:00. Test of 2 SD 200 and 1 SD 150 Cargo Pump
- 13:30 – 14:30. Test of 2 SD 200 and 1 SD 150 Cargo Pump.
- 15:00 – 16:00. Test of 2 SD 200 and 1 TK 100 Cargo/Portable Pump.
- 16:30 – 17:30. Test of 2 SD 200 and 1 TK 100 Cargo/Portable Pump.

Tuesday, 08.03.2016

(Ferry from Hatvik to Venjanaset 07:30)

- 08:00 – 08:30. Test of 2 SD 200 Cargo Pump. ✓ (warm up before arrival)
- 09:00 – 10:00. Test of 2 SD 200 Cargo Pump. ✓
- 10:30 – 11:30. Test of 2 SD 200 Cargo Pump. ✓
- 11:30 – 12:00. Lunch.
- 12:30 – 13:30. Test of 2 SD 200 Cargo Pump.
- 14:00 – 15:00. Test of 2 SD 200 Cargo Pump.
- 15:30 – 16:30. Test of 2 SD 200 Cargo Pump.

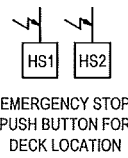
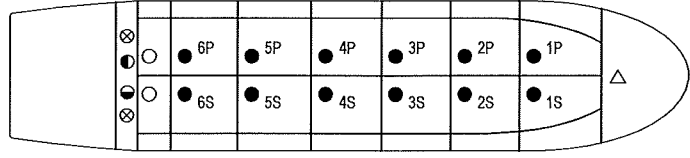


* = 3 SUPPORTS ONLY FOR TANK 6P / 6S

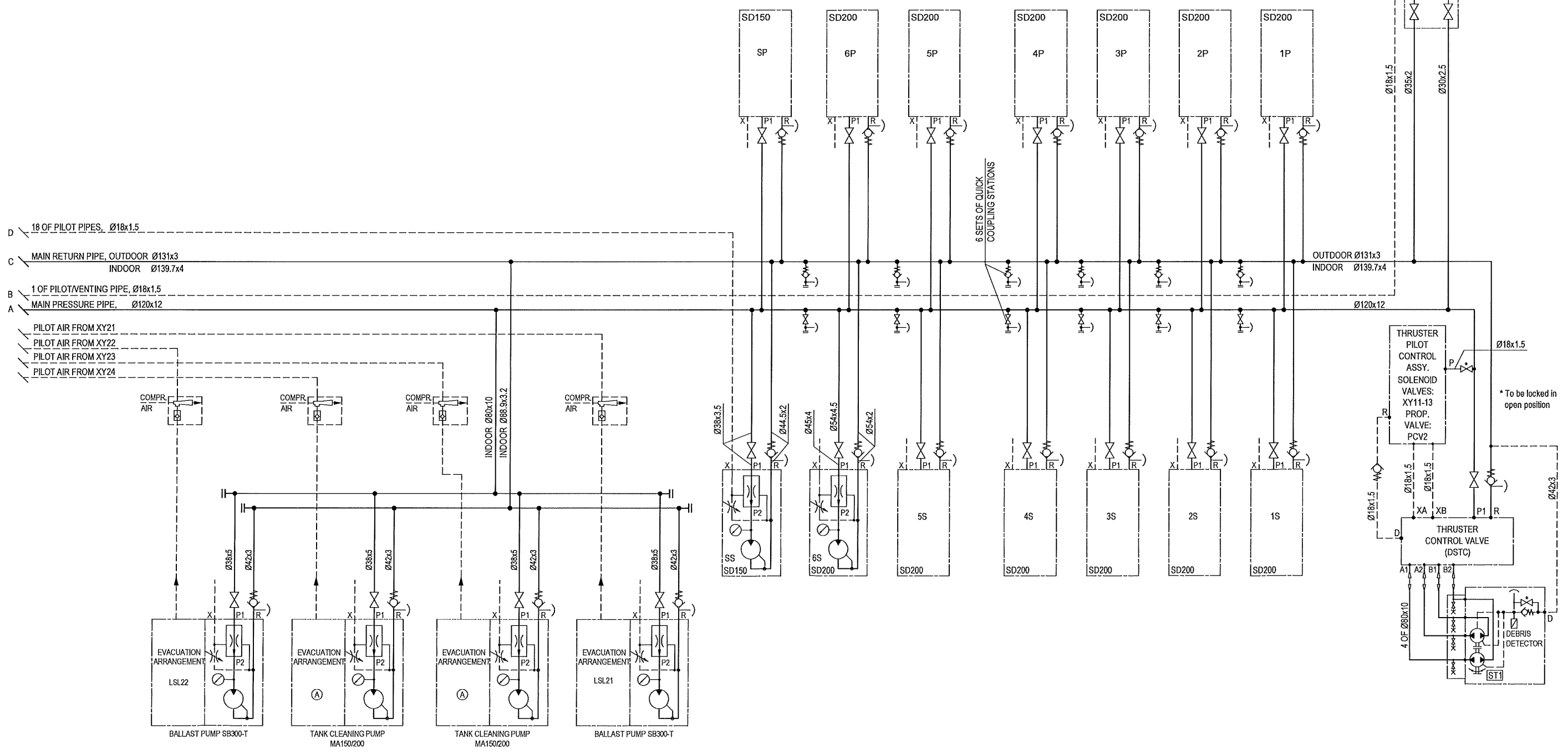
R.	Description	Sign./Date	Prod. rel.	BHo	30 Sep 14
		Status	Sign.	Date	
		Constr.	MAHO	28 Sep 14	
		Drawn by	JEOE	30 Sep 14	
		Checked	MAHO	30 Sep 14	
		Prod. rel.			
		Prod. rel.	BHo	30 Sep 14	

Frank Mohn AS		This drawing is our property. It is not to be traced, copied or published without our written consent, nor to be misused in any way.
GENERAL ARRANGEMENT		
Replaces: 0287-2814-1		
Replaced by:		

- 12 OF COP, TYPE SD200 - 600 m³/h - 125 mlc
- 2 OF COP, TYPE SD150 - 300 m³/h - 125 mlc
- ⊗ 2 OF WBP, TYPE SB300-T - 750 m³/h - 35 mlc
- 1 OF TCP, TYPE MA150/200 - 100 m³/h - 120 mlc
- 1 OF TCP, TYPE MA150/200 - 200 m³/h - 120 mlc
- △ 1 OF THRUSTER MOTOR - 750 kW - 1480 rpm



DEAERATING/VENTING
VALVES TO BE
ABOVE MAIN PRESSURE/
RETURN LINE HIGHEST
POINT AND EASY
TO ACCESS.



R.	Description	Sign./Date	Prod. rel.	BHo	01 Oct 14
A	Revised	JEOE/19Feb15	Prot. rel.		
	Checked	MAHO	01 Oct 14		
	Drawn by	JEOE	01 Oct 14		
	Constr.	MAHO	01 Oct 14		
	Status				

Frank Mohn AS

HYDRAULIC
DIAGRAM
DECK SECTION

Replaces:

0216-2368-102

Replaced by:

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1 System data

Hydraulic oil consumers

Consumers	Design capacity				Hydraulic data	
	m ³ /h	mlc	kg/dm ³	cSt	l/min	bar
12 of Cargo pumps SD200	600	125	0,8	1,0	570	255
2 of Cargo pumps SD150	300	125	0,8	1,0	323	221
1 of Portable pump TK100	150	70	0,8	1,0	145	194 C
2 of Ballast pumps SB300-T	750	35	1,025	1,0	286	250
1 of TCP MA150/200	200	120	1,025	1,0	370	188 B
1 of TCP MA150/200	100	120	1,025	1,0	240	178
	kW		rpm			
1 of Thruster motor	750		1480		2337	221

Hydraulic oil supply

2 of Electric hydraulic power packs 2 x 856 l/min = 1712 l/min / 279 bar
 2 of Diesel hydraulic power packs 2 x 865 l/min = 1730 l/min / 279 bar
 Total hydraulic oil supply: = 3442 l/min / 279 bar

Simultaneous operation (design)

6 of Cargo pumps SD200 (3600 m³/h - 125 mlc – 0,8 kg/dm³ - 1,0 cSt)= 3420 l/min / 279 bar

Simultaneous operation (examples)

Number and type of consumers	Max. oil consumption l/min	Number and type of power packs	Max. oil supply l/min
1 x SD200	570	1 x Electric	856
2 x SD200	1140	2 x Electric	1712
4 x SD200	2280	2 x Electric + 1 x Diesel	2577
6 x SD200	3420	2 x Electric + 2 x Diesel	3442
Thruster	2337	2 x Electric + 1 x Diesel	2577

Heat dissipation - Ventilation

Hydraulic power unit heat dissipation: 116 kW

Recommended ventilation capacity for hydraulic power pack room: 11,3 m³/s
 (Based upon inlet temperature 35°C, 10°C temperature rise, specific heat capacity 1.005kJ/kgK and gas constant 0.287kJ/kgK. Combustion air for diesel engines is also included).



TECHNICAL SYSTEM DATA

No. 0076-1446-4
 Date/sign.: 16Feb15/MaHo
 Page: 2 of 4
 Rev:C (04.03.2016)

2 Component data

Electric motors

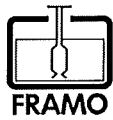
Characteristics	Main power packs	Feed pump	Hydraulic oil transfer unit
Number of motors	2	3	1
Protection (IP)	55	55	55
Power supply (V / Hz / Ph)	440 / 60 / 3	440 / 60 / 3	440 / 60 / 3
Power installed (kW)	470	12,5	1,3
Speed (rpm)	1780	3495	3460
Current (A)	744	19,8	2,6
Starting current (direct) (A)	4464	150	16
Efficiency (%)	96	90,5	
Power factor (Cos φ)	0,87	0,91	
Heating power at 110 V (W)	2 x 65	25W	NA
Insulation- / Temp. rise class	F / F	F / F	F / B
Remarks			

Note: Maximum, allowable, power output for the type of electric motor at specified conditions, and given on the motor name plate.
 For design and dimensioning of electric starters, power cables etc., required power (i.e. power output required for the specific order(s)) and corresponding parameters to be used.

Diesel engines

Data based upon ambient temperature 25°C at 760 mmHg and relative humidity of 30%

Characteristics		
Number of engines		2
Power installed: (kW)		485
Speed (rpm)		1800
Type of cooling water		Fresh Water
Heat transfer rate (kW)		351
Cooling water requirement (min./ max.) (m ³ /h)		15 – 21,6
Cooling water inlet temperature (°C)		36
Maximum cooling water inlet pressure (bar)		3,45
Cooling water pressure drop (min./ max.) (bar)		1,7 - 3,35
Specific fuel oil consumption (g/kWH)		212
Intake air flow (litres/s)		538
Exhaust gas flow (litres/s)		1463
Exhaust gas temperature (°C)		430
Maximum exhaust gas back pressure (mmHg)		76
<i>Air start:</i>		
Air consumption for air starter at: 6,2 bar (m ³ /s)		0,16
8,3 bar (m ³ /s)		0,21
10,3 bar (m ³ /s)		0,25
Maximum air inlet pressure (bar)		10,3



TECHNICAL SYSTEM DATA

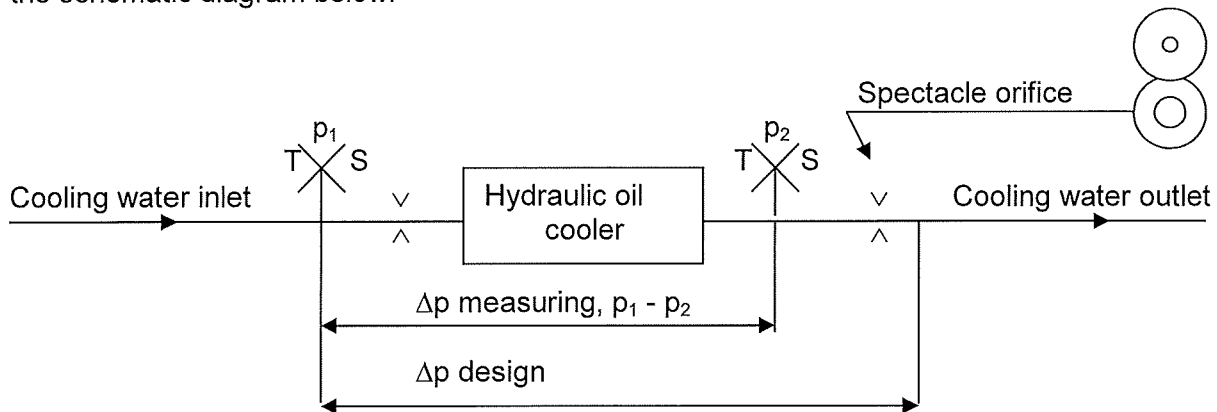
No. 0076-1446-4
Date/sign.: 16Feb15/MaHo
Page: 3 of 4
Rev:C (04.03.2016)

Hydraulic oil coolers

Number of coolers	1	
Type of cooling water:	Fresh Water	
Heat transfer rate:	511 kW	
Cooling water inlet temperature:	36 °C	
Minimum required cooling water flow:	110 m ³ /h	
Pressure drop at minimum required flow:	20 mwc (Δp design)	A
	19,2 mwc (Δp measuring, $p_1 - p_2$)	A
Maximum cooling water flow:	120 m ³ /h	A
Maximum cooling water inlet pressure:	40 mwc	

For cooling water pressure drop curve (Δp measuring, $p_1 - p_2$), refer to the dimensional drawing for the cooling water accessories.

The cooling water accessories include a spectacle orifice in the cooling water outlet line, refer to the schematic diagram below.



The “free” bore of the spectacle orifice marked “adjustable” (the smallest of the two) to be modified at site during commissioning and used instead of the one assembled, if required for one of the following reasons:

- measured pressure drop (Δp measuring, $p_1 - p_2$) is outside the min./ max. range given above.
- measured pressure drop (Δp measuring, $p_1 - p_2$) is within the min./ max. range given above, but higher cooling water flow than minimum required makes disturbance of the cooling water balance onboard.

Cargo pumps

Inert gas/air consumption for one stripping sequence of each pump SD200:	4.0 Nm ³
Inert gas/air consumption for one stripping sequence of each pump SD150:	1,7 Nm ³
Required inert gas/air pressure:	6 - 7 bar
Number of stripping sequences for each pump:	2 (max. 3)

Portable winch

Air consumption:	78 Nm ³ /h
Required air pressure:	6-7 bar



3 Hydraulic oil, Lubricants and Fuel

Hydraulic oil

For type of oil, see separate instruction.

Total oil volume in the system except for storage/ drain tank, is approximately 8 m³.

B

Lubricants

Bearing grease for electric motors:

Good quality lithium base or lithium complex grease.

Base oil viscosity 100 - 140 cSt at 40°C.

Consistency grade 2 or 3.

Temperature range -30°C - +120°C continuously.

Lubricating oil for diesel engines:

For type of oil, see separate instruction.

Lubricating oil type on engines at delivery:

Shell Rimula Super SAE15-40

Total volume: 50 litres (Cummins)

Fuel

DMA marine distillate fuel according to ISO 8217 to be used for diesel engines.

Others

Coolant for diesel engines:

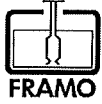
For type of coolant, see separate instruction.

Coolant type on engines at delivery:

Glyco Shell (40 %) added

Fleetguard DCA4 coolant additive

Total volume: 66 litres (Cummins)



**Performance test procedure
for
Framo hydraulically driven pumps**

CONTENTS

Chapter	Content
1	Scope
2	Test arrangement
3	Oil filling
4	Start-up
5	Performance test
6	Evaluation of performance test
7	Control of seal arrangement
8	Blinding



PERFORMANCE TEST PROCEDURE

No. 0074-0046-401
Date/sign.: 27Mar95/BHo
Page: 2 of 5
Rev. I: 17Oct13/ED

1. Scope

The purpose of the test is to verify the performance of the pump.

This test procedure is applicable to Framo hydraulically driven pumps, type SD, SB, VH, VF, M and TK-series.

Test to be in accordance with EN ISO 9906 Grade 2.

2. Test arrangement

SD-series pumps - appendix 1.
SB, VH, VF and M-series pumps - appendix 2.
TK-series pumps - appendix 3.

Test fluid shall be clean, cold, fresh water. Hydraulic fluid used during tests is "Shell Tellus 46". Calibration certificates shall be available at test site for all instruments used during the test.

3. Oil filling

Prior to start-up the pump's return side must be filled with oil.

4. Start-up

During start-up it is important to be extra careful before all parts of the pump have been filled with oil, i.e. run the pump very slowly in the beginning.

Run the pump at 50 bar for 15 minutes, and then increase to 150 bar for 15 minutes.

5. Performance Test

If a prolonged performance test is specified (more than 15 minutes), the cofferdam must be checked prior to this test.

Run the pump for 15 minutes at rated capacity/head according to pump specification. Record data at the end of this period.

In addition one of the pumps in a series to be run against closed cargo valve.

Results from performance test to be registered in a test protocol linked to order no.

6. Evaluation of Performance Test

The test protocol shall be used as base for judgement of pump compliance with design requirements.

7. Control of seal arrangement

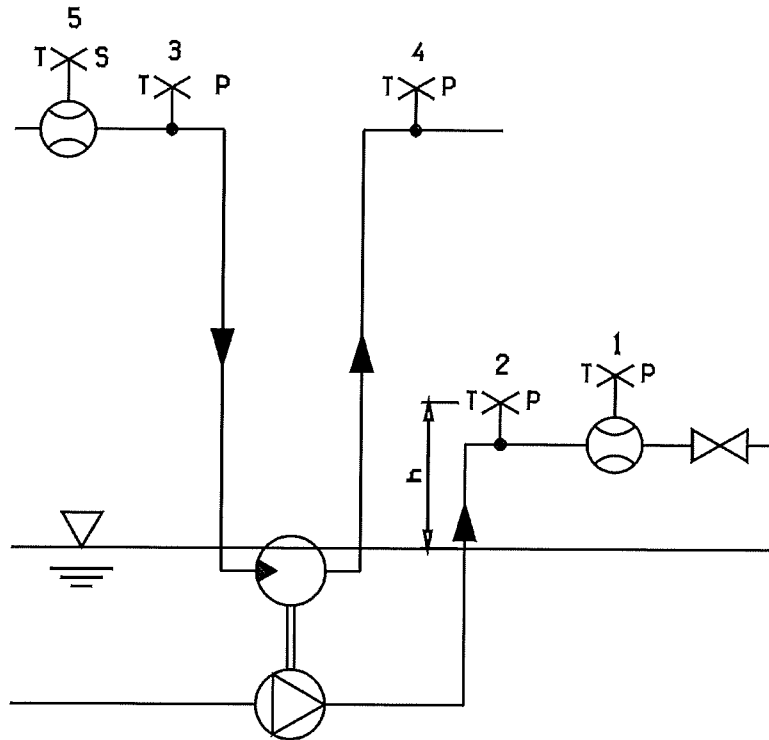
Check cofferdam for leakage. Maximum allowable leakage: 5 ml/h.

8. Blinding

The pump to be dismantled from test equipment and the hydraulic connections blanked off.

Appendix 1

Test arrangement - SD-series pumps

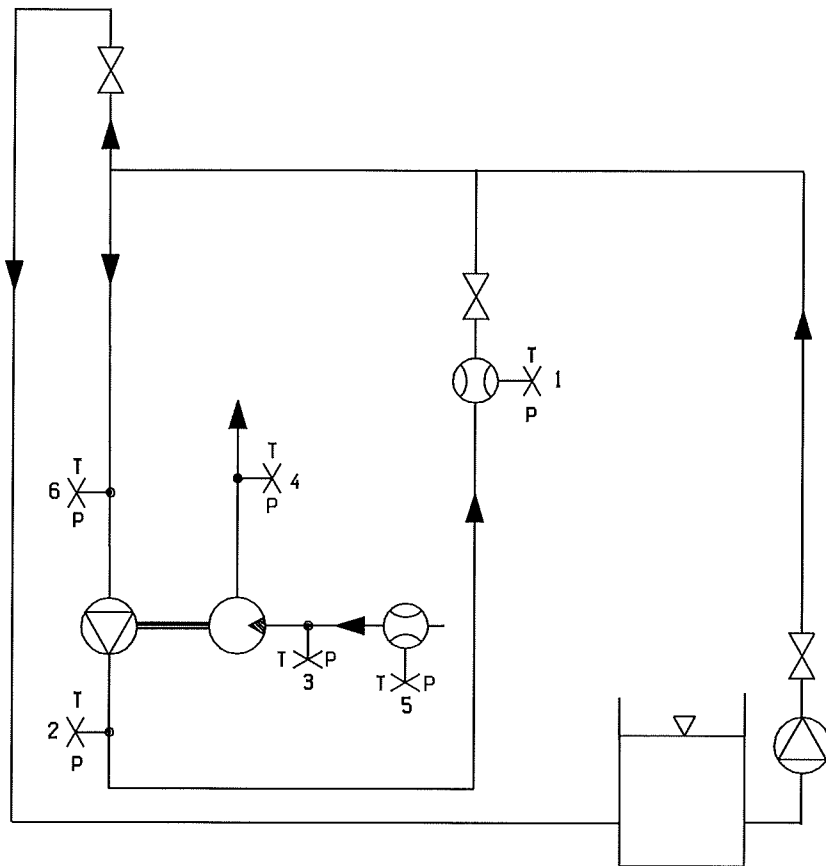


Test point	Measured variable
TP1	Water flow
TP2	Discharge head
TP3	Hydraulic pressure
TP4	Hydraulic return pressure
TP5	Hydraulic oil flow
h	Static height

Appendix 2

Test arrangement

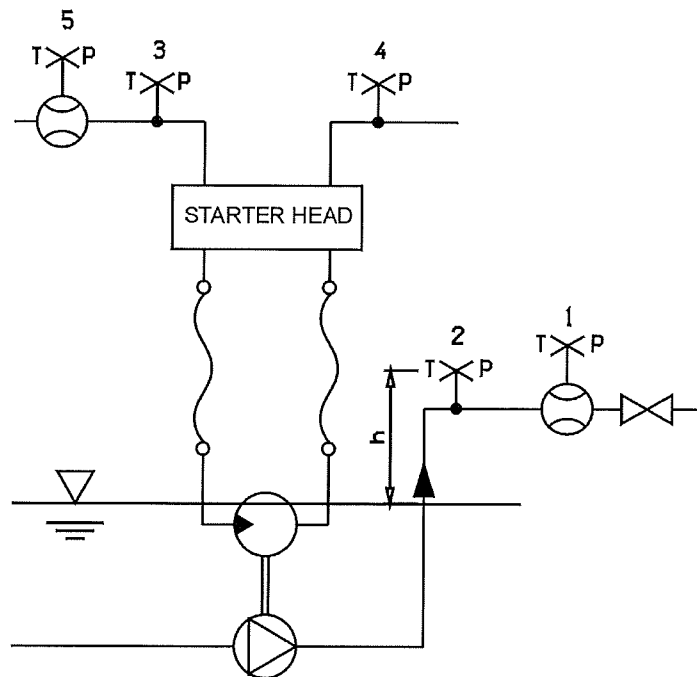
- SB-series pumps
- VH-series pumps
- VF-series pumps
- M-series pumps
- PB-series pumps
- BP-series pumps



Test point	Measured variable
TP1	Water flow
TP2	Discharge head
TP3	Hydraulic pressure
TP4	Hydraulic return pressure
TP5	Hydraulic oil flow
TP6	Suction-/feed pressure

Appendix 3

Test arrangement - TK-series pumps



Test point	Measured variable
TP1	Water flow
TP2	Discharge head
TP3	Hydraulic pressure
TP4	Hydraulic return pressure
TP5	Hydraulic oil flow
h	Static height



Note to test procedure Acceptance Criteria

04.03.2016 / MaHo

Note with regards to expected values for the performance test and the acceptance criteria's for order 617600/601, HNo. 1053/1054 :

Expected value of the results is stated in the pump specifications. Test results to be in accordance with EN ISO 9906 Grade 2, giving the following requirements for the results:

Criteria for Hydr. Pressure, Δp + 5 %

Criteria for oil consumption + 3 %

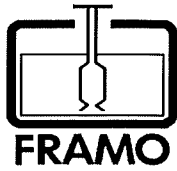
Criteria for effect + 8 %

Cargo pumps, SD200 maximum acceptable values	
Hydraulic oil pressure Δp ,:	255 bar x 1.05 = 268 bar
Hydraulic oil consumption,:	510 l/min x 1.03 = 525 l/min
Effect acceptance criteria (oil flow) x (Δp)	208 kW

Slop pumps, SD150 maximum acceptable values	
Hydraulic oil pressure Δp ,:	221 bar x 1.05 = 232 bar
Hydraulic oil consumption,:	289 l/min x 1.03 = 298 l/min
Effect acceptance criteria (oil flow) x (Δp)	105 kW

Portable pumps, TK 100 maximum acceptable values	
Hydraulic oil pressure Δp ,:	230 bar x 1.05 = 242 bar
Hydraulic oil consumption,:	145 l/min x 1.03 = 149 l/min
Effect acceptance criteria (oil flow) x (Δp)	49kW

(Results are rounded to the nearest whole number.)



PUMP SPECIFICATION

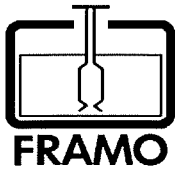
No.: **0115-1742-401**

Date/Sign.: 02.10.14/MaHo

Page: 1 of 1

Rev.:

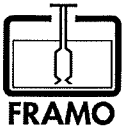
PUMP DATA	TYPE: SD200-6 DTHH200-C347		
	SERVICE: Cargo		
MATERIALS	CASING: EN1.4432		
	IMPELLER: CF3M+Mo	SHAFT: EN1.6582	
DRAWINGS, INSTALLATION AND CONSTRUCTION	DRAWING/INFORMATION Calculation procedure Pipestack specification	DRAWING NO: 0115-1742-411 See Framo Specific	REMARKS: Internal use only
PERFORMANCE DATA	CHARACTERISTIC:	DUTY:	TEST FM: REMARKS:
	Capacity (m3/h)	600	537
	Head (mlc)	125	100
	Specific gravity (kg/dm3)	0,8	1,0
	Viscosity (cSt)	1,0	1,0
	Power required (kW)	215,7	192,9
	Speed (rpm)	2751	2461
	Hydraulic oil flow (l/min)	570	510
	Hydraulic oil pressure (bar)	255	255
ADDITIONAL INFORMATION	Control valve setting: 570 l/min 279 bar		
	Control valve codification: STC40-T -* -P-R		
	Total weight, empty: 1331 kg		
	Oil volume: 142 litre		
	Option: Temp sensor		
	Impeller diameter: 347		
	Internal use only: A35433		



PUMP SPECIFICATION

No.: 0115-1742-403
 Date/Sign.: 02.10.14/MaHo
 Page: 1 of 1
 Rev.: C MaHo 04.04.16

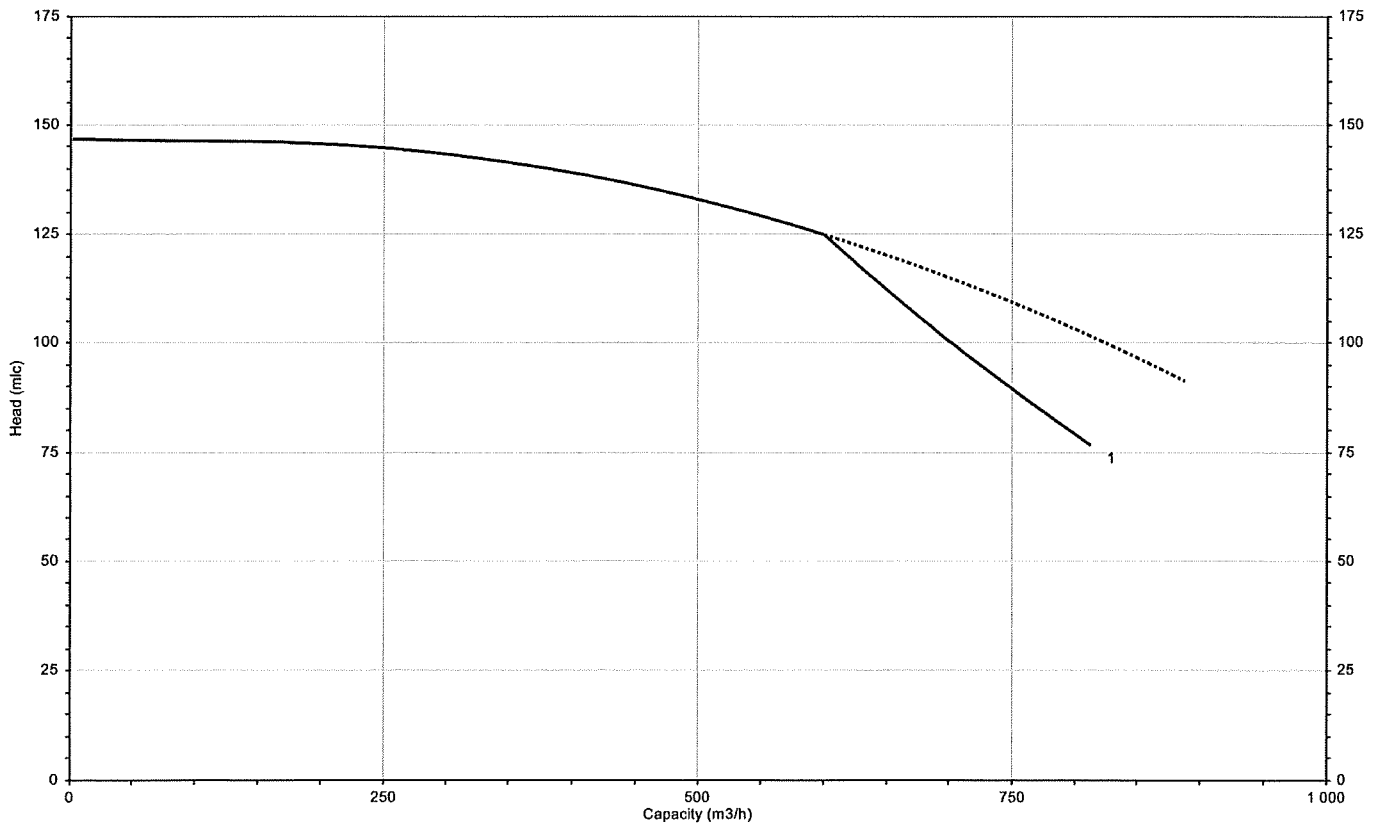
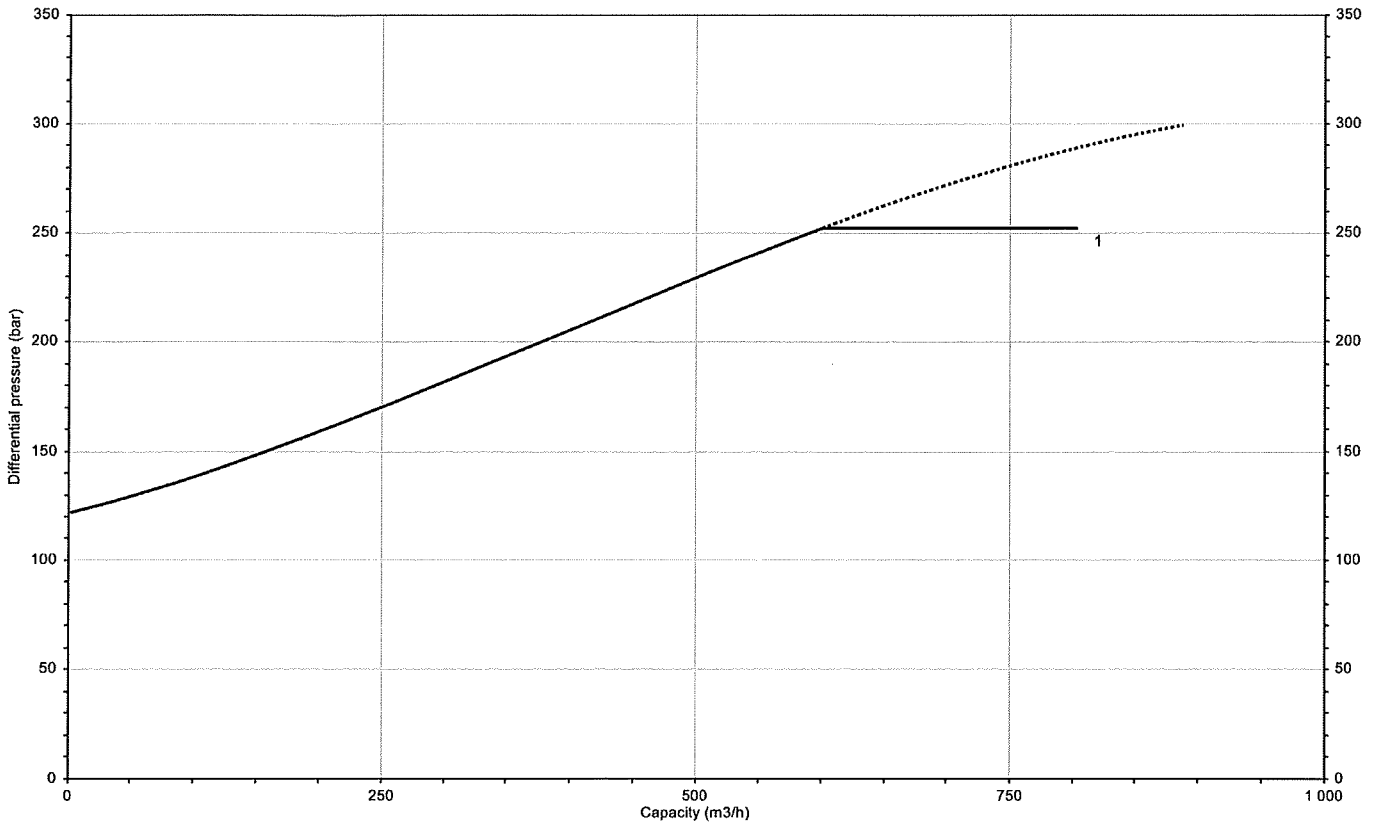
PUMP DATA	TYPE: <p style="text-align: center;">TK100 DUHH32-A178</p>		
	SERVICE: <p style="text-align: center;">Portable</p>		
MATERIALS	CASING: <p style="text-align: center;">EN1.4432</p>		
	IMPELLER: <p style="text-align: center;">EN1.4432</p>	SHAFT: <p style="text-align: center;">EN1.8507</p>	
DRAWINGS, INSTALLATION AND CONSTRUCTION	DRAWING/INFORMATION Calculation procedure Pipestack specification	DRAWING NO: 0115-1742-413 See Framo Specific	REMARKS: Internal use only
PERFORMANCE DATA	CHARACTERISTIC: Capacity (m3/h) Head (mlc) Specific gravity (kg/dm3) Viscosity (cSt) Power required (kW) Speed (rpm) Hydraulic oil flow (l/min) Hydraulic oil pressure (bar)	DUTY: 150 70 0,8 1,0 42,7 4356 145 194	TEST FM: 150 70 1,0 1,0 53,3 4356 145 230
ADDITIONAL INFORMATION	Control valve setting: 145 l/min 279 bar Control valve codification: SC20/TK100 Total weight, empty: 71 kg Oil volume: 0 litre Option: No options Impeller diameter: 178		

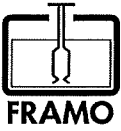


PERFORMANCE DIAGRAM FRAMO PUMP SD200-6

No.: 0169-4046-4
Date/Sign.: 16.02.15/MAHO
Rev.: A
Page: 1 of 3

Capacity:	600 (m ³ /h)	Specific gravity:	0,800 (kg/dm ³)	No.	(bar)
Head:	125 (m _{lc})	Viscosity:	1 (cSt)	1	255
Speed:	2751 (rpm)	Impeller	347 (mm)		
Driver:	A2FM 200				

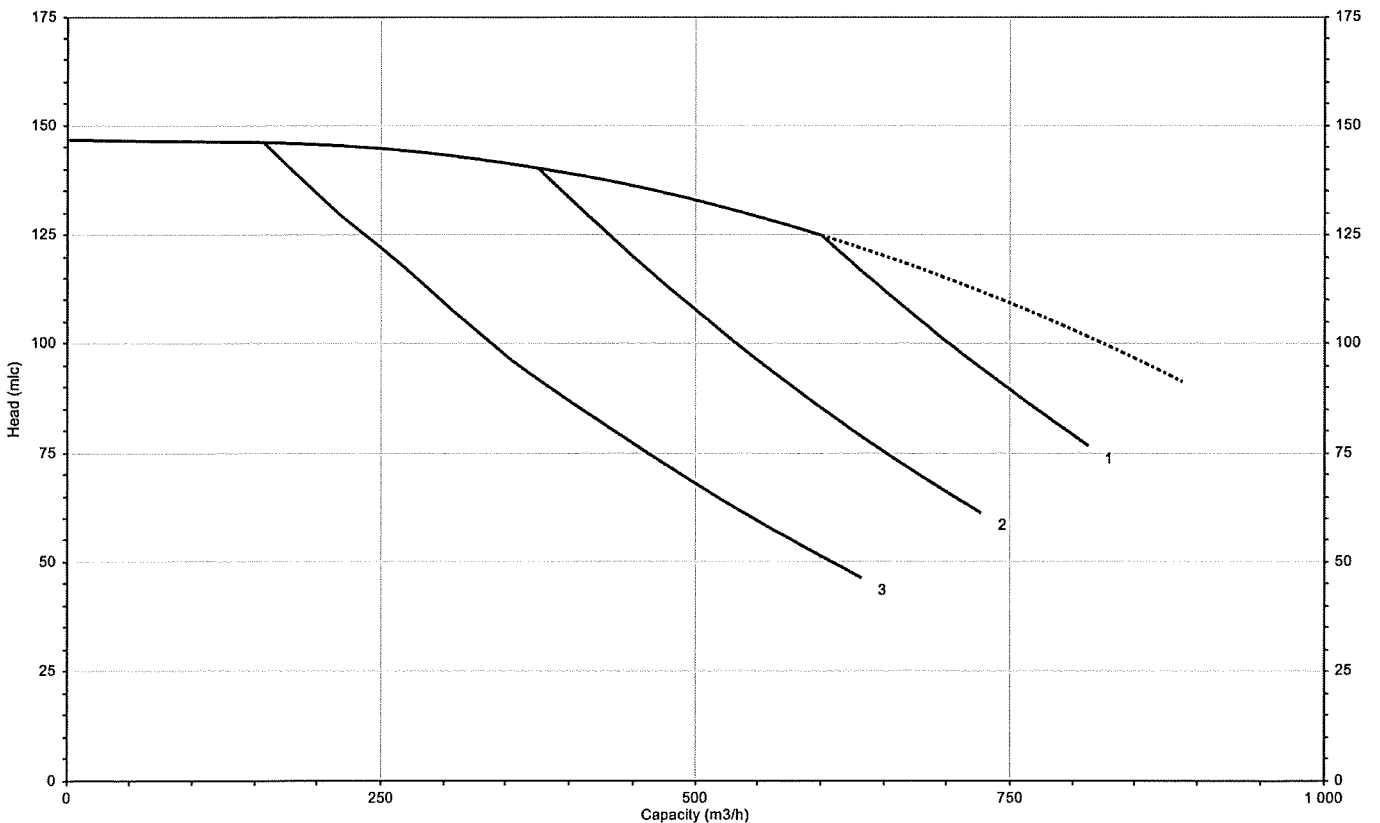
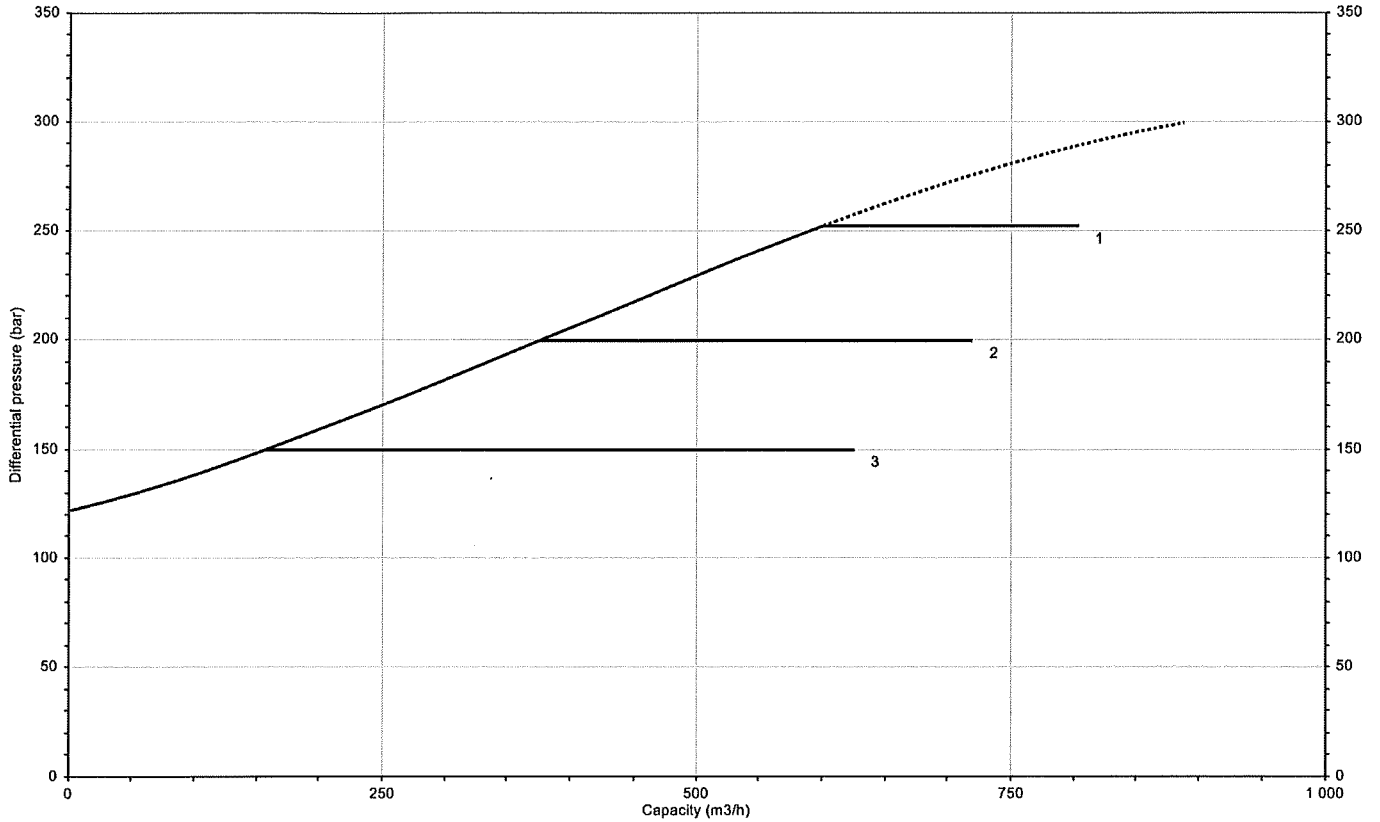


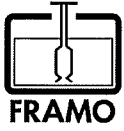


PERFORMANCE DIAGRAM FRAMO PUMP SD200-6

No.: 0169-4046-4
Date/Sign.: 16.02.15/MAHO
Rev.: A
Page: 2 of 3

Capacity:	600 (m ³ /h)	Specific gravity:	0,800 (kg/dm ³)	No.	(bar)
Head:	125 (mlc)	Viscosity:	1 (cSt)	1	255
Speed:	2751 (rpm)	Impeller	347 (mm)	2	200
Driver:	A2FM 200			3	150

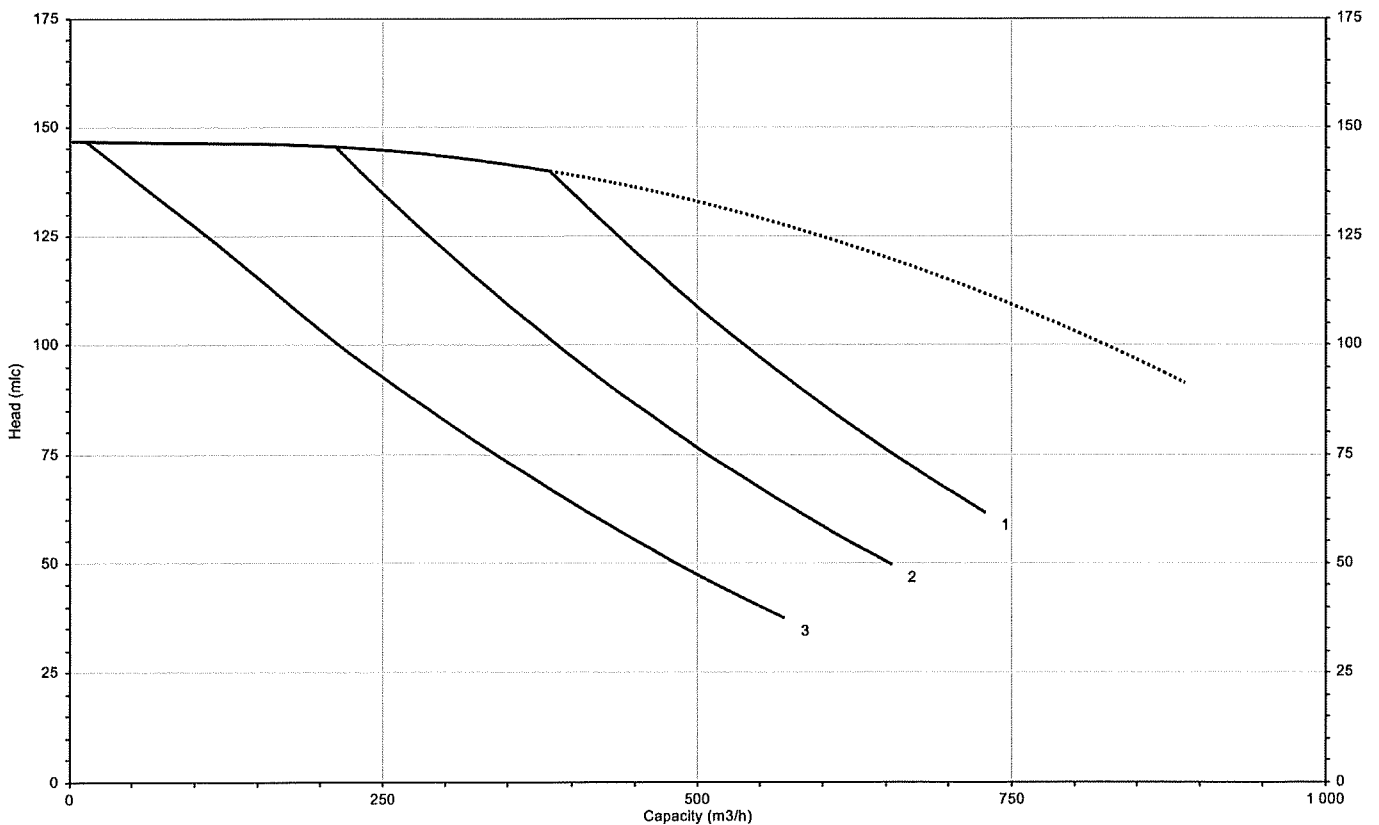
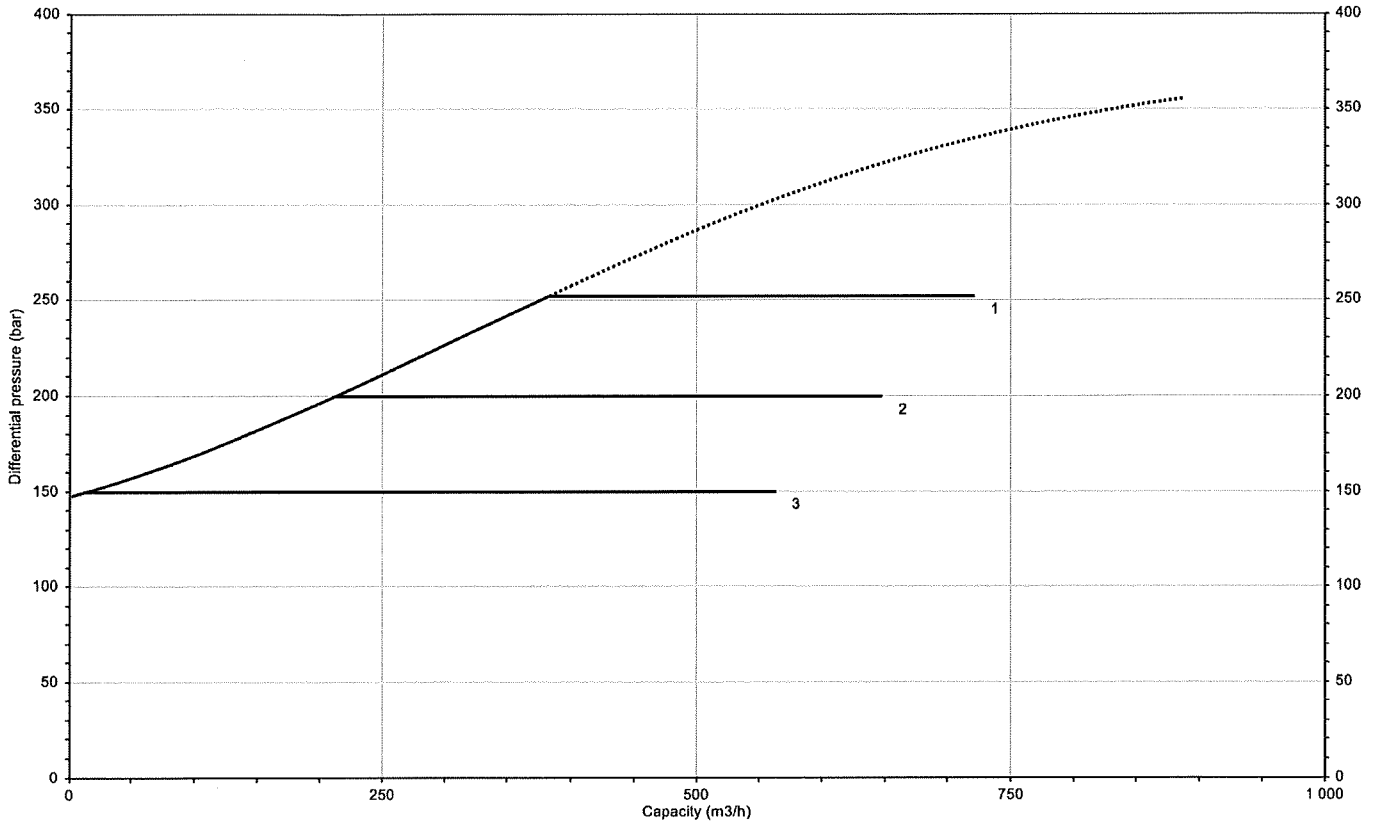


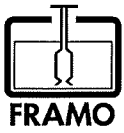


PERFORMANCE DIAGRAM FRAMO PUMP SD200-6

No.: 0169-4046-4
Date/Sign.: 16.02.15/MAHO
Rev.: A
Page: 3 of 3

Capacity:	600 (m ³ /h)	Specific gravity:	1,000 (kg/dm ³)	No.	(bar)
Head:	125 (m/c)	Viscosity:	1 (cSt)	1	255
Speed:	2751 (rpm)	Impeller	347 (mm)	2	200
Driver:	A2FM 200			3	150

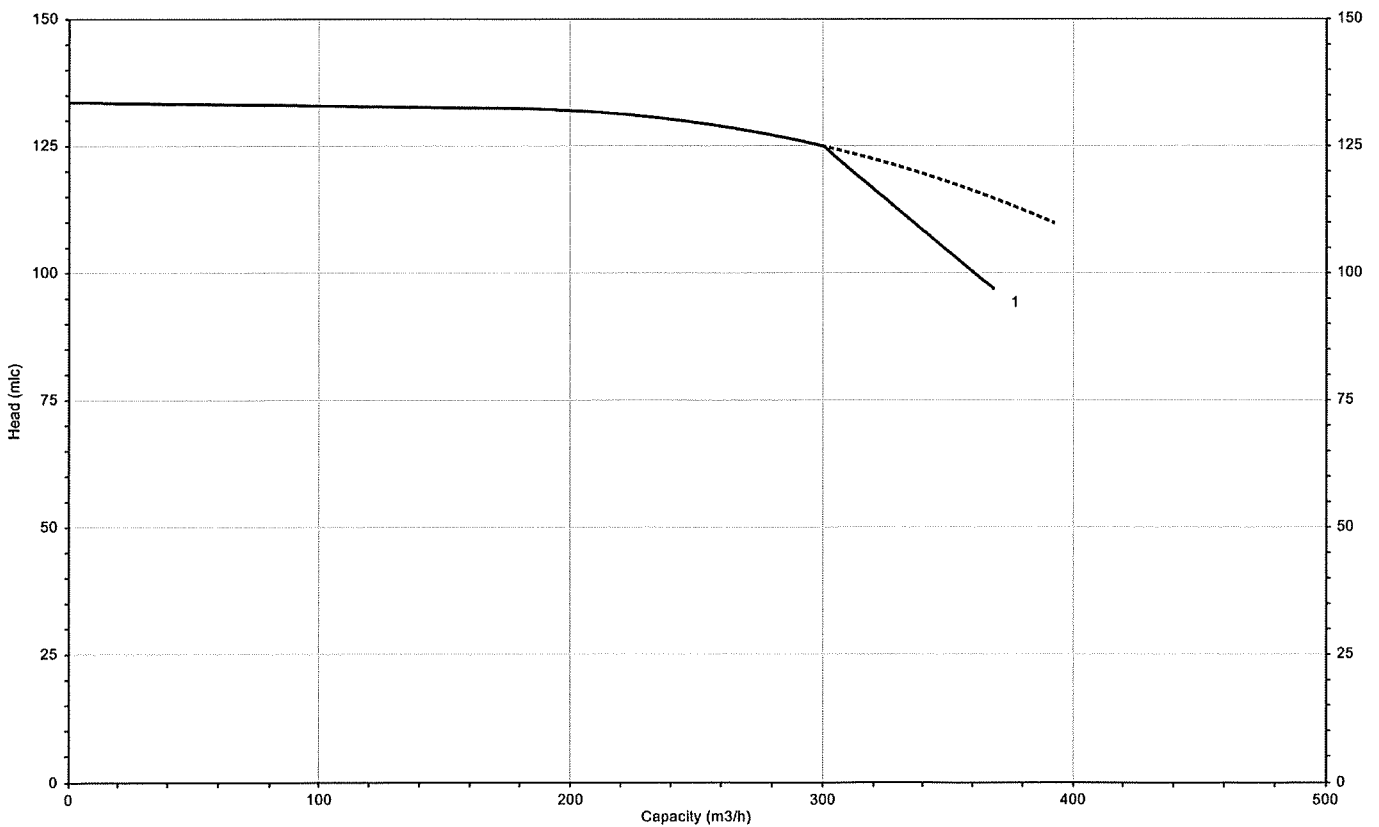
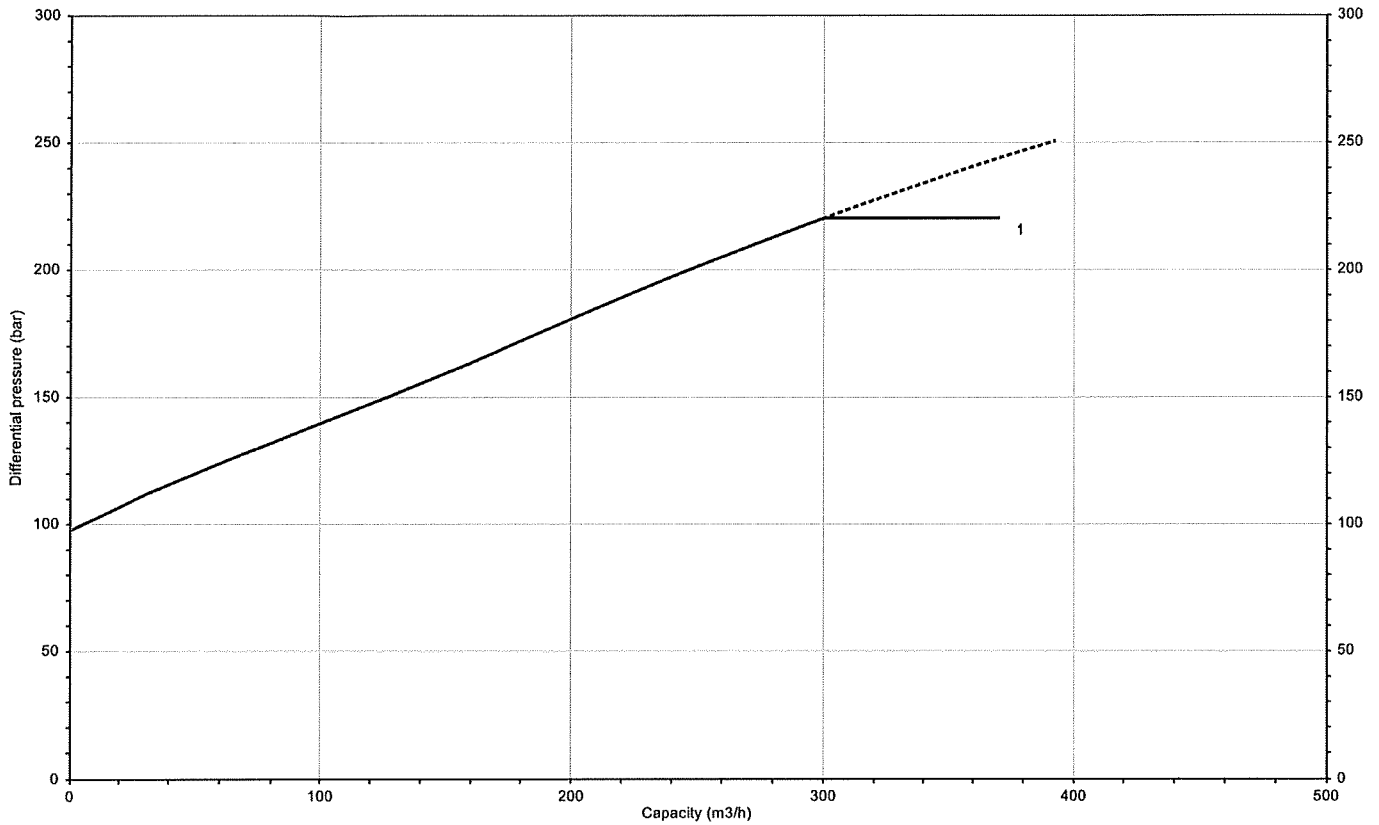




PERFORMANCE DIAGRAM FRAMO PUMP SD150-6

No.: 0169-4047-4
Date/Sign.: 16.02.15/MAHO
Rev.: A
Page: 1 of 3

Capacity:	300 (m3/h)	Specific gravity:	0,800 (kg/dm3)	No.	(bar)
Head:	125 (m/c)	Viscosity:	1 (cSt)	1	221
Speed:	2928 (rpm)	Impeller	315 (mm)		
Driver:	A2FM 107				

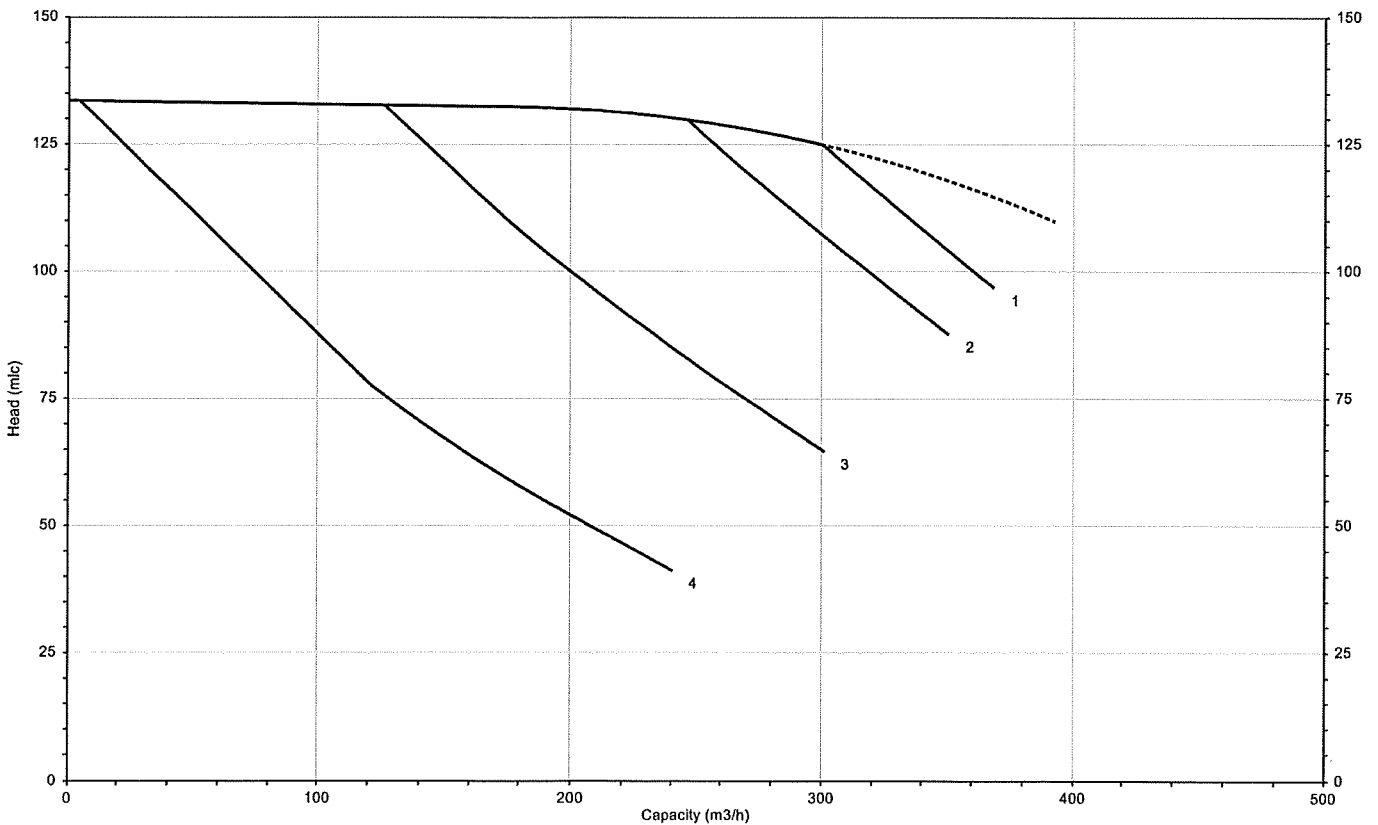
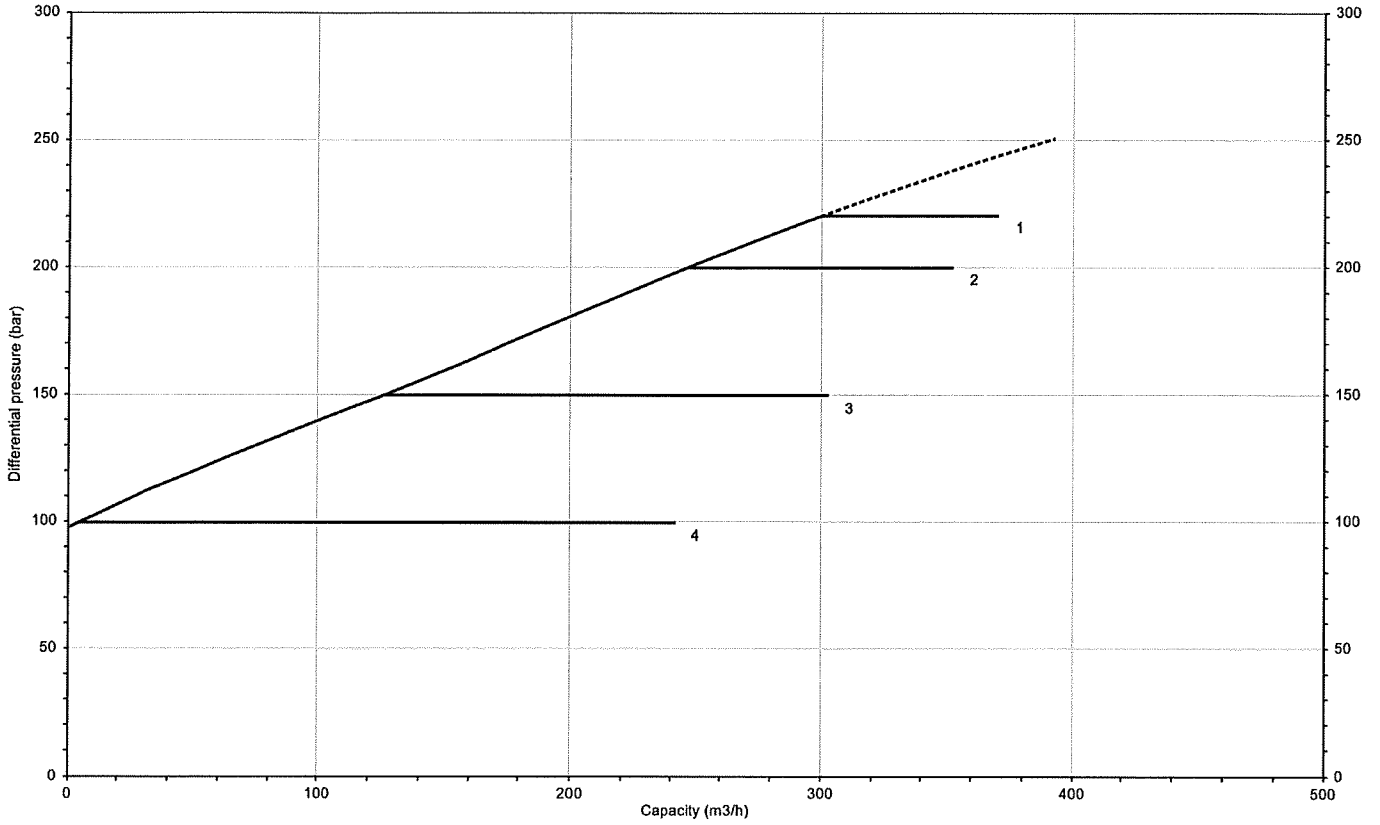




PERFORMANCE DIAGRAM FRAMO PUMP SD150-6

No.: 0169-4047-4
Date/Sign.: 16.02.15/MAHO
Rev.: A
Page: 2 of 3

Capacity:	300 (m3/h)	Specific gravity:	0,800 (kg/dm3)	No.	(bar)	No.	(bar)
Head:	125 (mlc)	Viscosity:	1 (cSt)	1	221	4	100
Speed:	2928 (rpm)	Impeller	315 (mm)	2	200		
Driver:	A2FM 107			3	150		

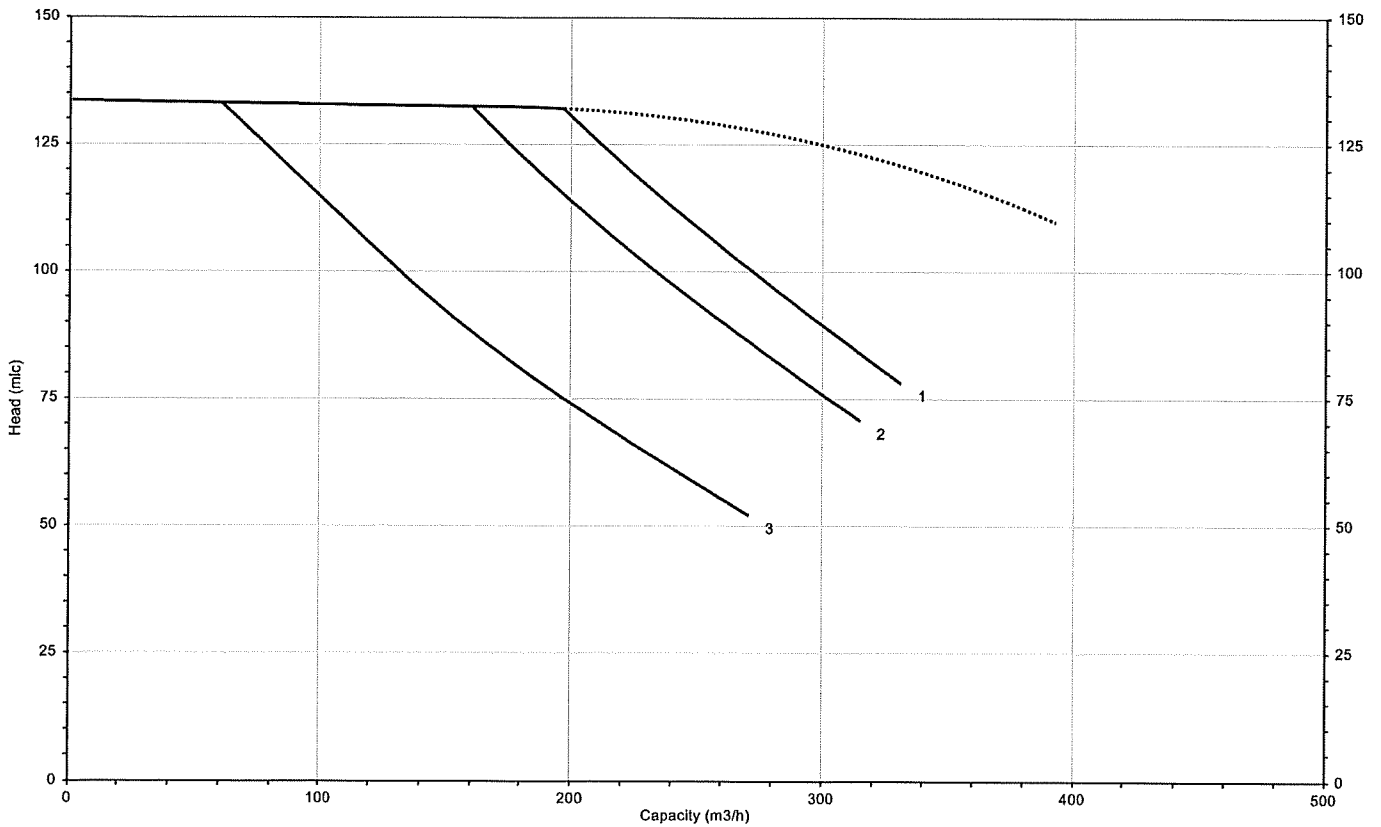
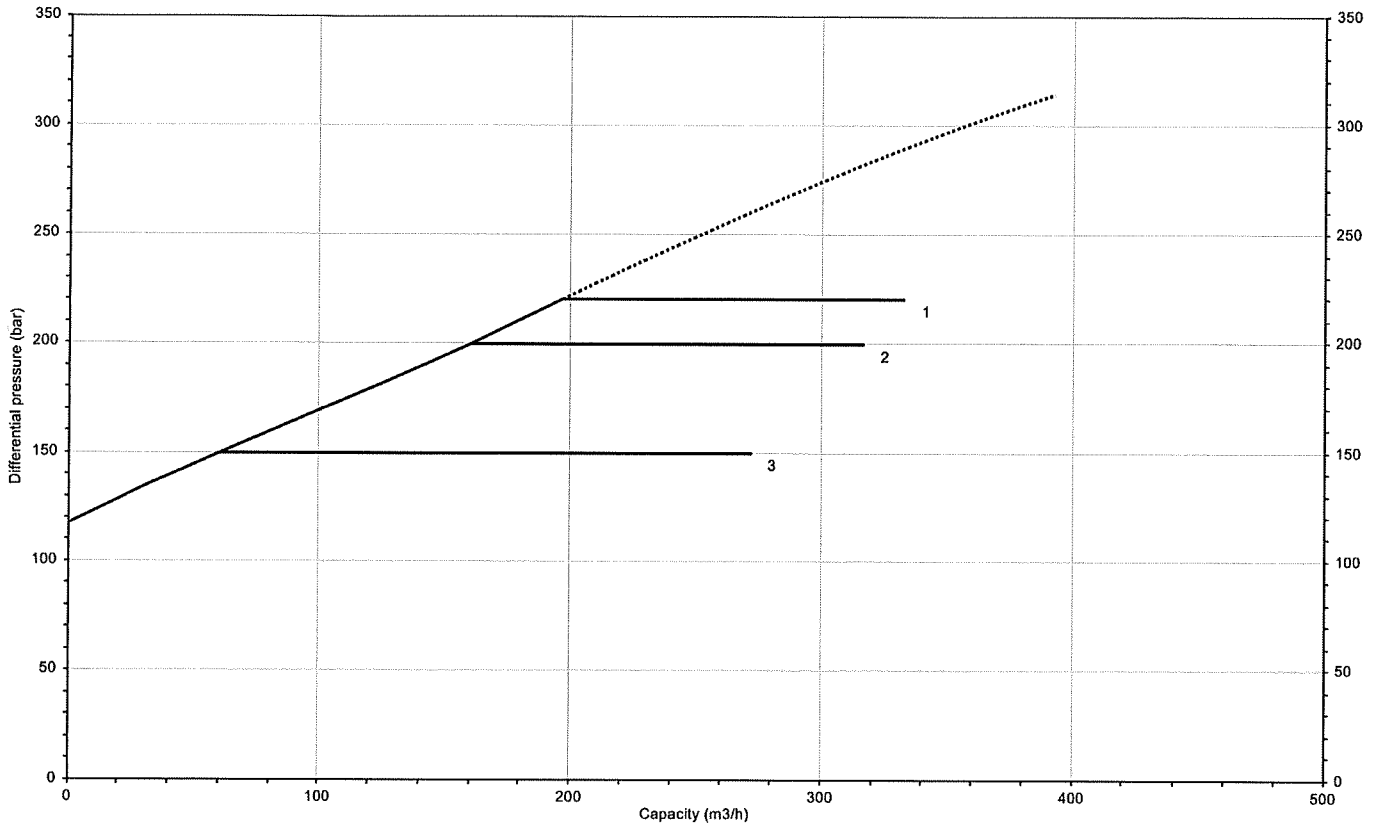


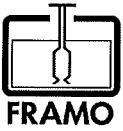


PERFORMANCE DIAGRAM FRAMO PUMP SD150-6

No.: 0169-4047-4
Date/Sign.: 16.02.15/MAHO
Rev.: A
Page: 3 of 3

Capacity:	300 (m3/h)	Specific gravity:	1,000 (kg/dm3)	No.	(bar)
Head:	125 (m/c)	Viscosity:	1 (cSt)	1	221
Speed:	2928 (rpm)	Impeller	315 (mm)	2	200
Driver:	A2FM 107			3	150

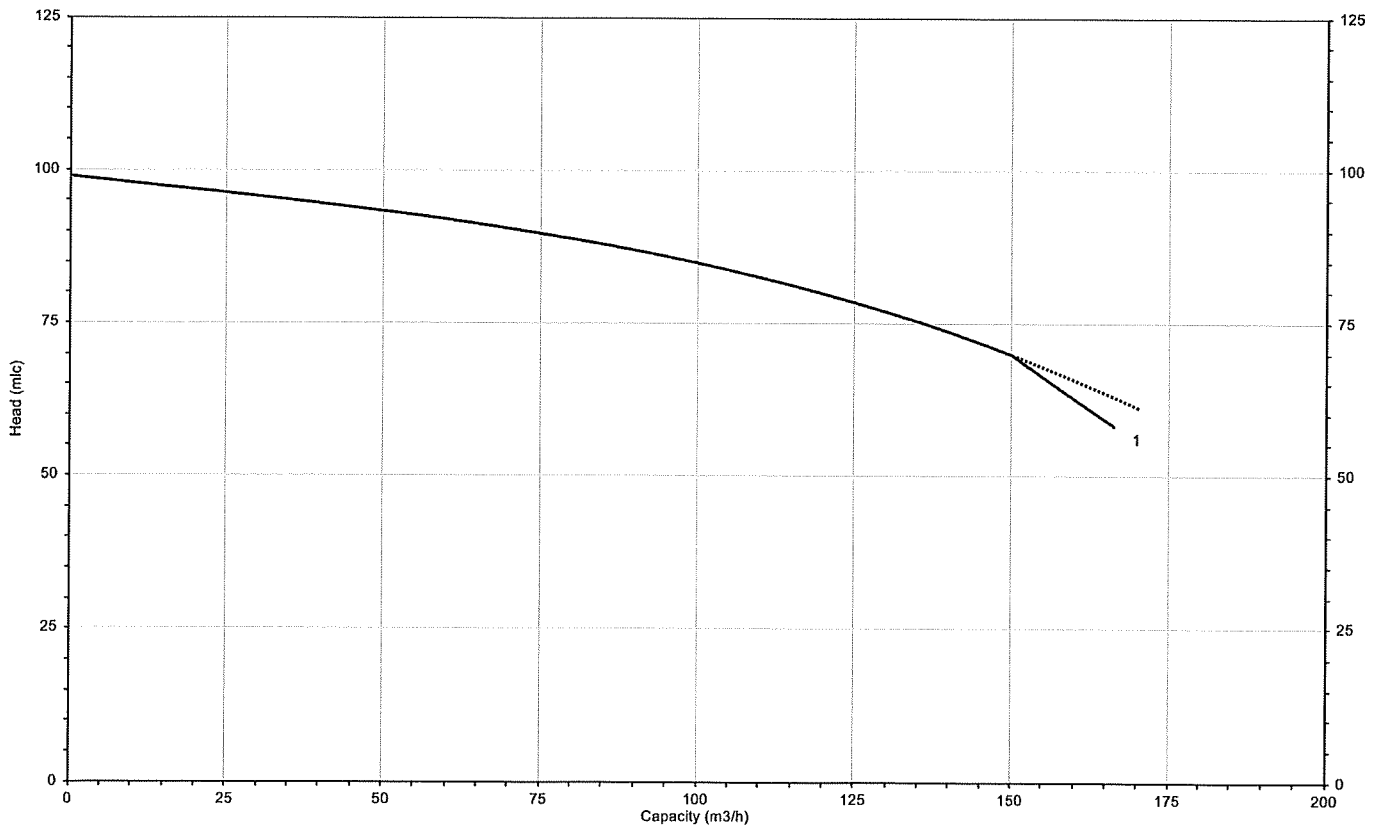
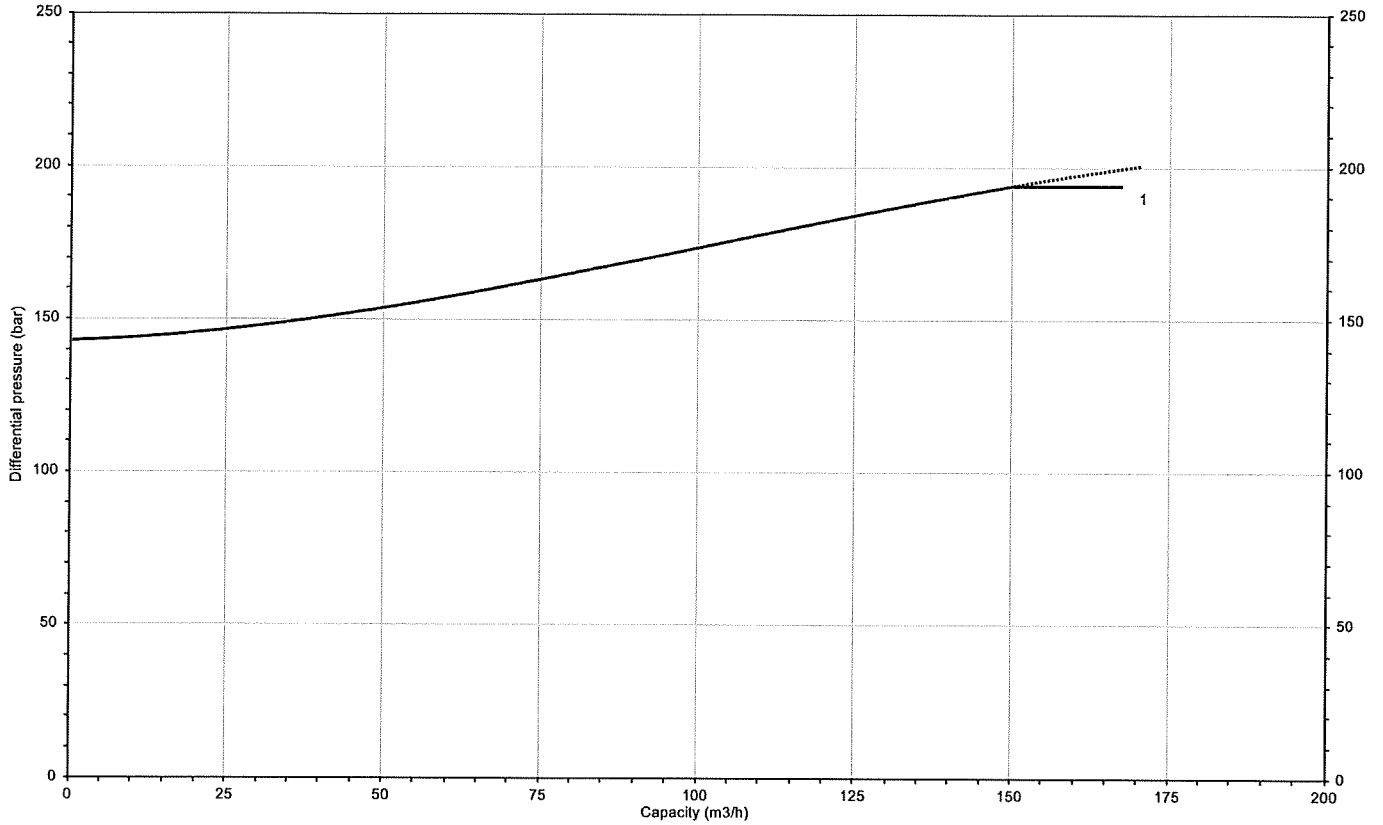


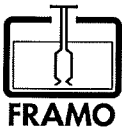


PERFORMANCE DIAGRAM FRAMO PUMP TK100

No.: 0169-4123-4
Date/Sign.: 04.03.16/MAHO
Rev.: A
Page: 1 of 2

Capacity:	150 (m ³ /h)	Specific gravity:	0,800 (kg/dm ³)	No.	(bar)
Head:	70 (mlc)	Viscosity:	1 (cSt)	1	194
Speed:	4356 (rpm)	Impeller	178 (mm)		
Driver:	A2FM 32				

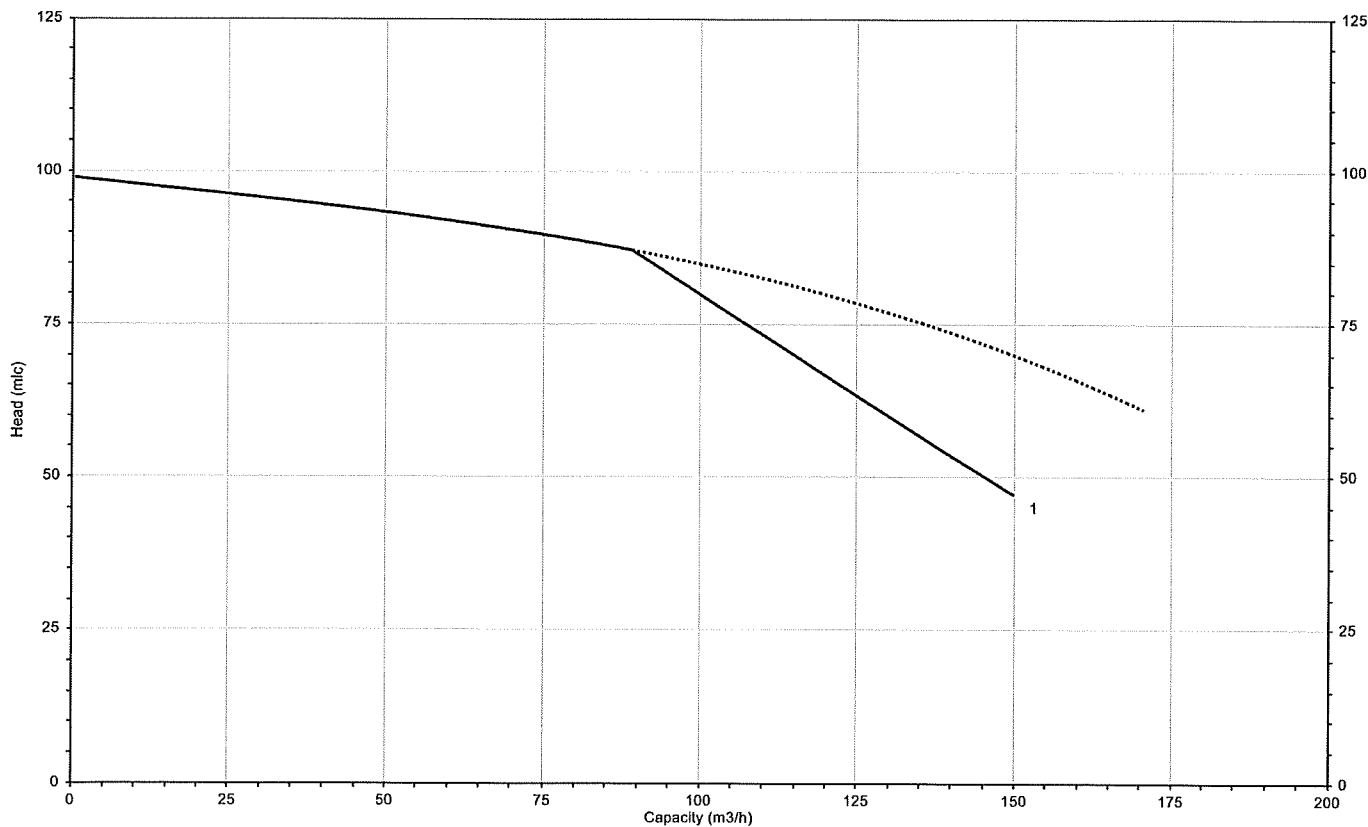
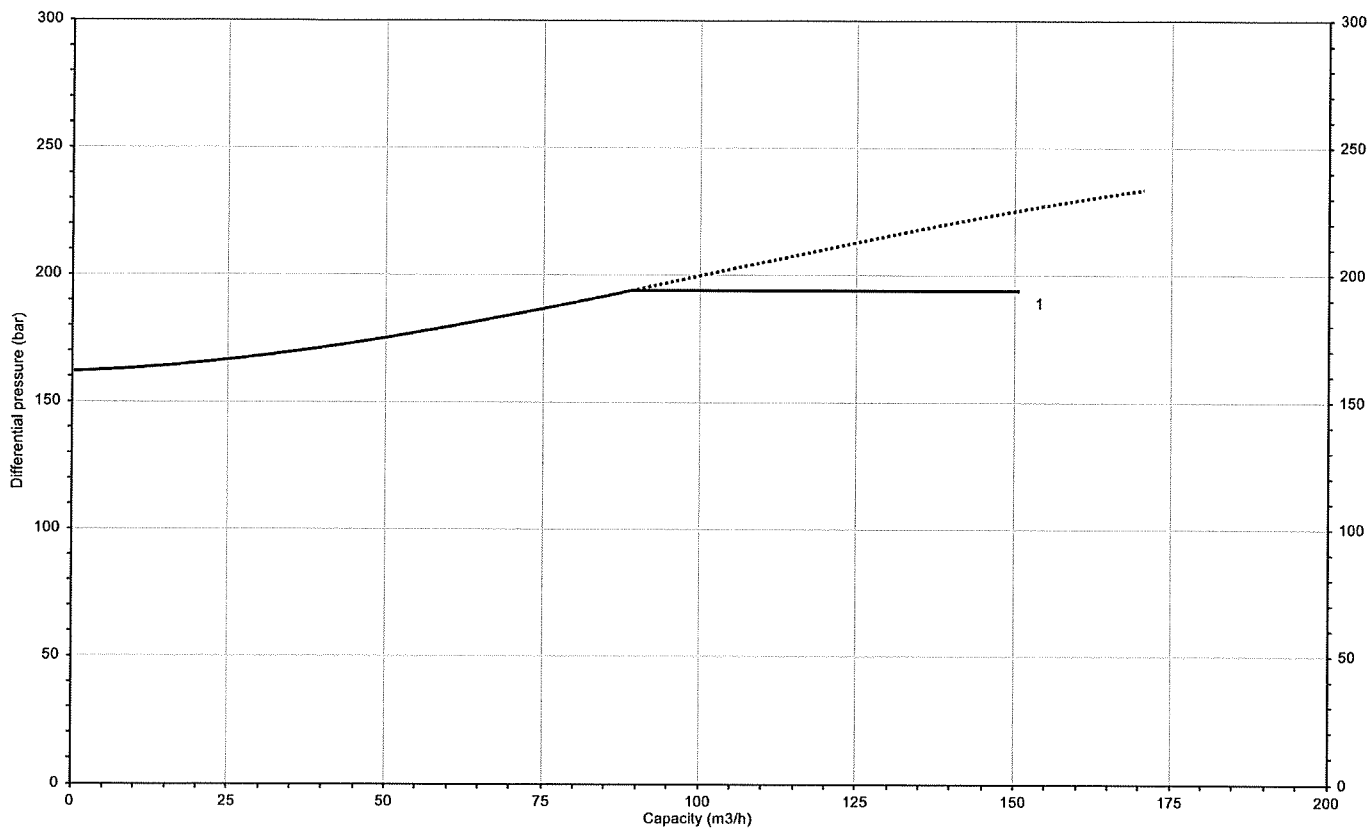





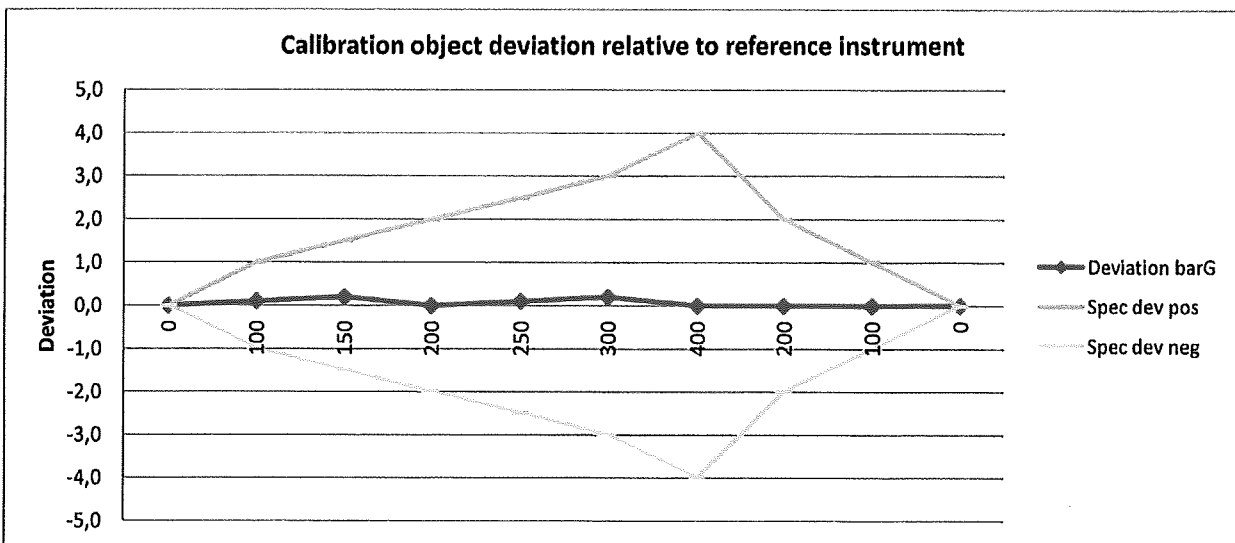
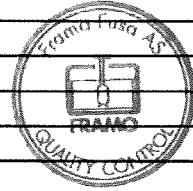
PERFORMANCE DIAGRAM FRAMO PUMP TK100


No.: 0169-4123-4
Date/Sign.: 04.03.16/MAHO
Rev.: A
Page: 2 of 2

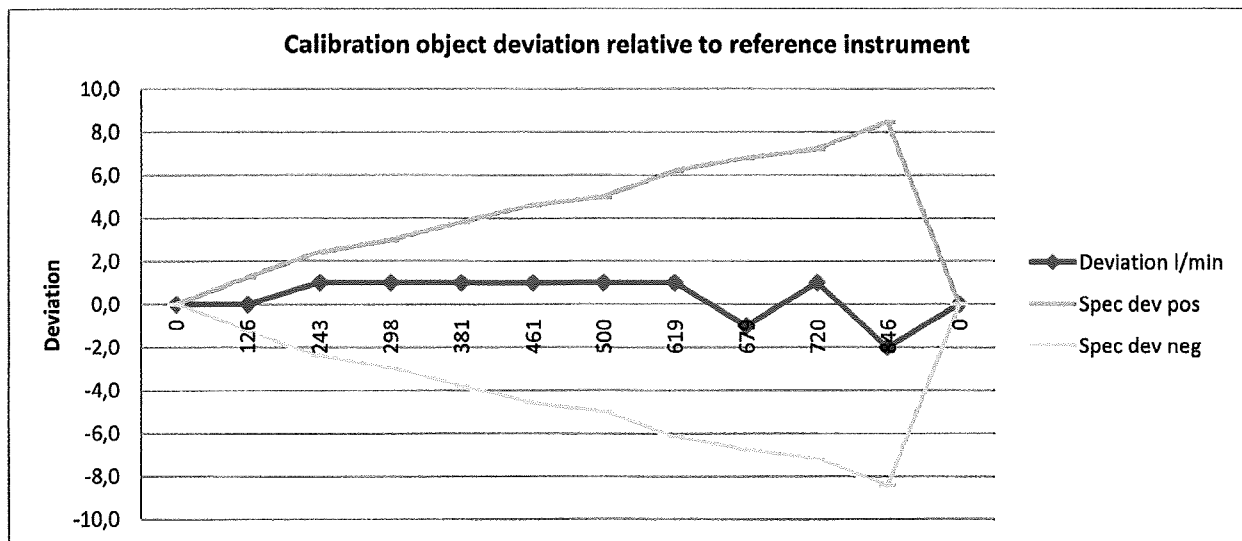
Capacity:	150 (m ³ /h)	Specific gravity:	1,000 (kg/dm ³)	No.	(bar)
Head:	70 (m _{lc})	Viscosity:	1 (cSt)	1	194
Speed:	4356 (rpm)	Impeller	178 (mm)		
Driver:	A2FM 32				




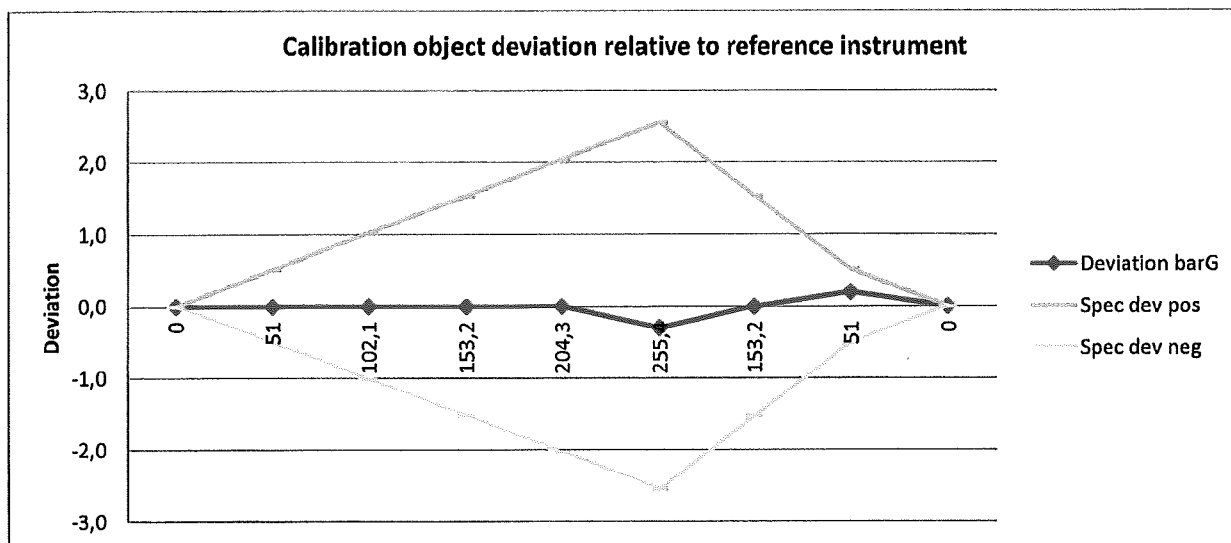
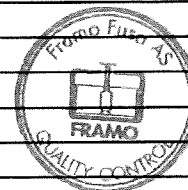
Certificate of calibration		 FRAMO an Alfa Laval brand	
		Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Pressure transmitter	Calibrator:	Digital Pressure Calibrator
Test instrument:	PT RY2C	Type:	CRYSTAL
Serial no:	360307-002	Model:	XP2i
Range:	0-400	Range:	0-700 bar
Unit:	barG	Serial no:	651629
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	K. Aakre		
Date:	30.12.2015	Offset	795
Valid through:	des. 16	Gain	1000
Approved by:	O. J. Gjerde	<i>Ole J. Gjerde</i>	
Calibration object	Calibrator	Deviation	Deviation
READOUT	LOAD	barG	%
0,0	0,0	0,0	
100,1	100,0	0,1	0,10
150,2	150,0	0,2	0,13
200,0	200,0	0,0	0,00
250,1	250,0	0,1	0,04
300,2	300,0	0,2	0,07
400,0	400,0	0,0	0,00
200,0	200,0	0,0	0,00
100,0	100,0	0,0	0,00
0,0	0,0	0,0	
Cal temperature (deg C) 20,7		Max deviation:	0,13


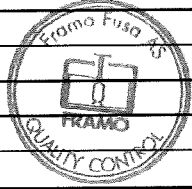


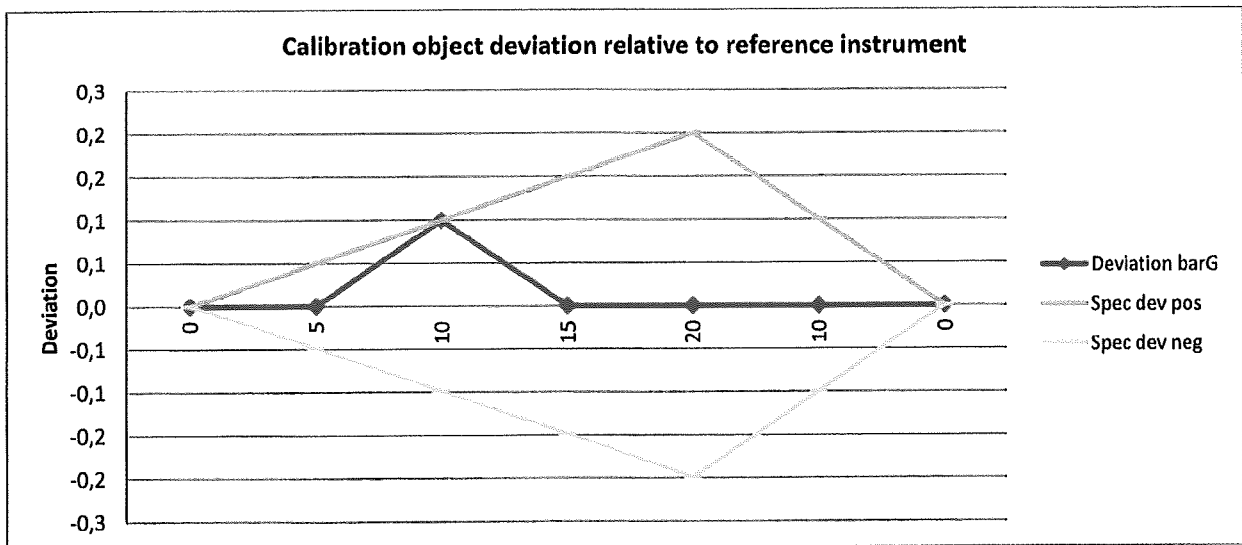
Certificate of calibration		 Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Oilflow turbinemeter	Calibrator:	Turbinemeter
Test instrument:	RY2 Cargo	Type:	Flow Technology
Serial no:	4001305	Model:	FT40
Range:	0-1500	Range:	0-1500l/min
Unit:	l/min	Serial no:	4001315
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	Jon Alfheim		
Date:	27.01.2016	Offset	800
Valid through:	jan. 17	Gain	1000
Approved by:	O.J.Gjerde	<i>Ole Gjerde</i>	
Calibration object	Calibrator	Deviation	Deviation
READOUT	READOUT	l/min	%
0,0	0,0	0,0	
126,0	126,0	0,0	0,00
244,0	243,0	1,0	0,41
299,0	298,0	1,0	0,34
382,0	381,0	1,0	0,26
462,0	461,0	1,0	0,22
501,0	500,0	1,0	0,20
620,0	619,0	1,0	0,16
678,0	679,0	-1,0	-0,15
721,0	720,0	1,0	0,14
844,0	846,0	-2,0	-0,24
0,0	0,0	0,0	
Cal temperature (deg C) 42		Max deviation:	0,41



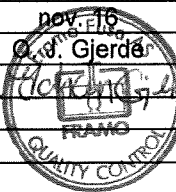


Certificate of calibration		 Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Pressure transmitter	Calibrator:	Digital Pressure Calibrator
Test instrument:	HT RY2C	Type:	CRYSTAL
Serial no:	8462173	Model:	XP2i
Range:	1,1-256,5	Range:	0-30 bar
Unit:	mlc	Serial no:	069283
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	K. Aakre		
Date:	30.12.2015	Offset	800
Valid through:	des. 16	Gain	1000
Approved by:	O. J. Gjerde	<i>Olo J. Gjerde</i>	
Calibration object	Calibrator	Deviation	Deviation
READOUT	LOAD	mlc	%
1,1	0,0	0,0	
52,1	51,0	0,0	0,00
103,2	102,1	0,0	0,00
154,3	153,2	0,0	0,00
205,4	204,3	0,0	0,00
256,2	255,4	-0,3	-0,12
154,3	153,2	0,0	0,00
52,3	51,0	0,2	0,39
1,1	0,0	0,0	
NOTE!			
Calibration object is placed 1,1 meters above water level in testwell			
and readout of calibration object is adjusted accordingly.			
Cal temperature (deg C) 18,5		Max deviation:	0,39



Certificate of calibration		 Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Pressure transmitter	Calibrator:	Digital Pressure Calibrator
Test instrument:	PR RY2C	Type:	CRYSTAL
Serial no:	360299-002	Model:	XP2i
Range:	0-20	Range:	0-700 bar
Unit:	barG	Serial no:	651629
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	U. K Hjellestad		
Date:	06.01.2016	Offset	700
Valid through:	jan. 17	Gain	1001
Approved by:	O. J. Gjerde	<i>O. J. Gjerde</i>	
			
Calibration object	Calibrator	Deviation	Deviation
READOUT	LOAD	barG	%
0,0	0,0	0,0	
5,0	5,0	0,0	0,00
10,1	10,0	0,1	1,00
15,0	15,0	0,0	0,00
20,0	20,0	0,0	0,00
10,0	10,0	0,0	0,00
0,0	0,0	0,0	
Cal temperature (deg C) 20,8		Max deviation:	1,00



Certificate of calibration		 FRAMO <small>an Alfa Laval brand</small>	
		Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	MAG5100W DN300	Calibrator:	Magflo Verificator
Test instrument:	RB2	Operated by:	Axflow
Serial no:	041502H503		
Range:	0-2000	Reference to external Verification Certificate	
Unit:	m3h		
Accuracy :<	1,0 %		
Cal freq (months)	12		
Operator:	P Rasmussen (external)		
Date:	20.11.2015		
Valid through:			
Approved by:	 	Offset	800
		Gain	1000

SIEMENS MAGFLO® Verification Certificate

Customer:		MAGFLO® Identification:	
Name	Frank Mohn	TAG No./Name	0
Address	Fusa	Sensor Code No.	7ME65205DC132A
		Sensor Serial No.	041502H503
Phone		Transmitter Code No.	7ME692
Email		Transmitter Serial No.	N1DD063514
		Location	RB2

Results:		Verification file name or No.	File #2
	Transmitter		Passed
	Sensor Insulation		Passed
	Magnetic Circuit		Passed

Velocity	Current Output			Frequency Output		
	Theoretical	Actual	Deviation	Theoretical	Actual	Deviation
0,5m/s	4,800mA	4,800mA	0,05%	0,500kHz	0,500kHz	-0,06%
1,0m/s	5,600mA	5,603mA	0,19%	1,000kHz	1,002kHz	0,17%
3,0m/s	8,800mA	8,803mA	0,05%	3,000kHz	3,003kHz	0,10%

Current Output 4-20mA Frequency Output 0-10kHz

Transmitter Settings:		
Basic	Qmax.	2000,00 m³ /h
	Flow Direction	Positive
	Low flow Cut-off	1,50%
	Empty Pipe	OFF
Output	Current Output	ON (4-20mA)
	Time Constant	5,0 Sec.
	Relay Output	Error Level
	Digital Output	Pulse
	Frequency Range	N/A
	Time Constant	N/A
	Volume/pulse	1,0 m³/p
	Pulse width	0,066 sec.
	Pulse polarity	Positiv
	Totalizer 1 value before test	362845,53125 m³
Totalizer 1 value after test	362845,59375 m³	
Totalizer 2 value before test	4129,91943359 m³	
Totalizer 2 value after test	4129,91943359 m³	
Operating time in days	377	

Sensor Details:	
Size	DN 300 12 IN
Cal. Factor	60,14971924
Correction Factor	1,0
Excitation Freq.	3,125Hz


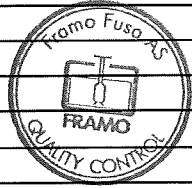
Vericator Details (083F5060)	
Serial No.	N1ED220002
Device No.	150004
Software Version	1.40
PC-Software Version	5.01
Cal. date	2015.01.23
ReCal. date	2016.01.23

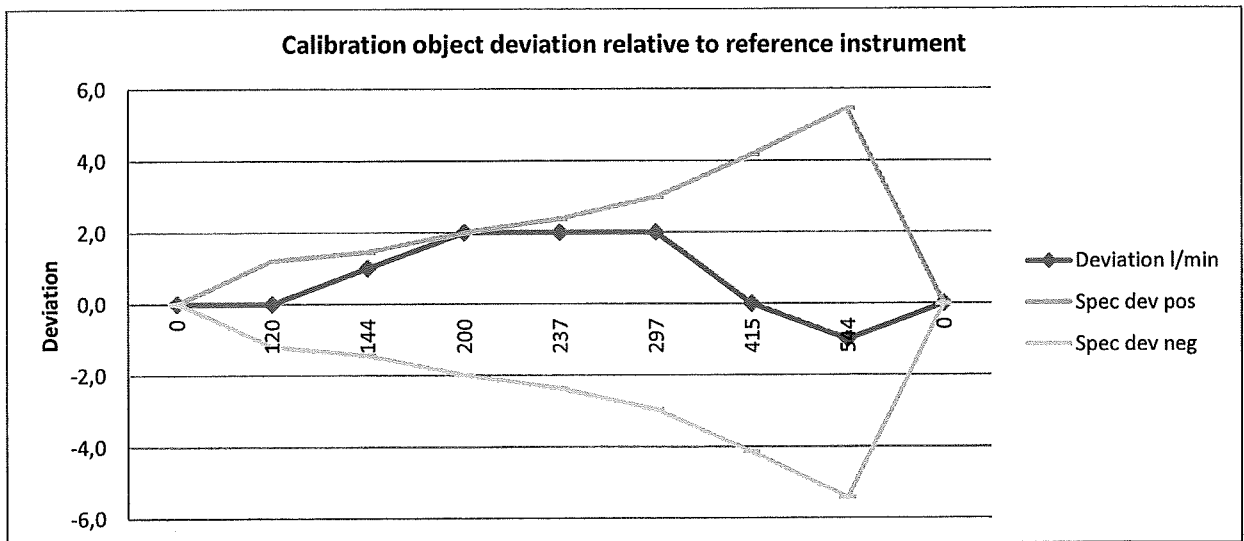
Comments


These tests verify that the flowmeter is functioning within 2% deviation of the original test parameters. Verification is traceable to National and International Standards.

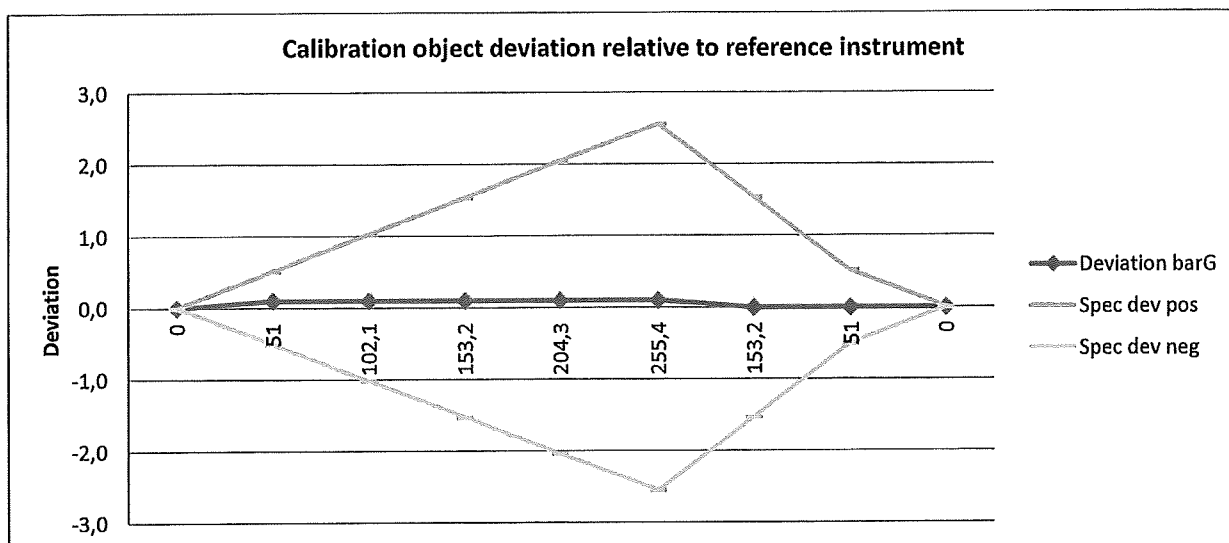
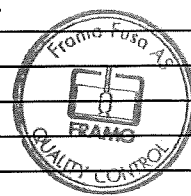
Date and signature 23/11/2015
2015.11.20


AXT LOWAS
Lilleakerveien 10
Postboks 98 Lilleaker
N-2216 OSLO
Paal-Andre Rasmussen

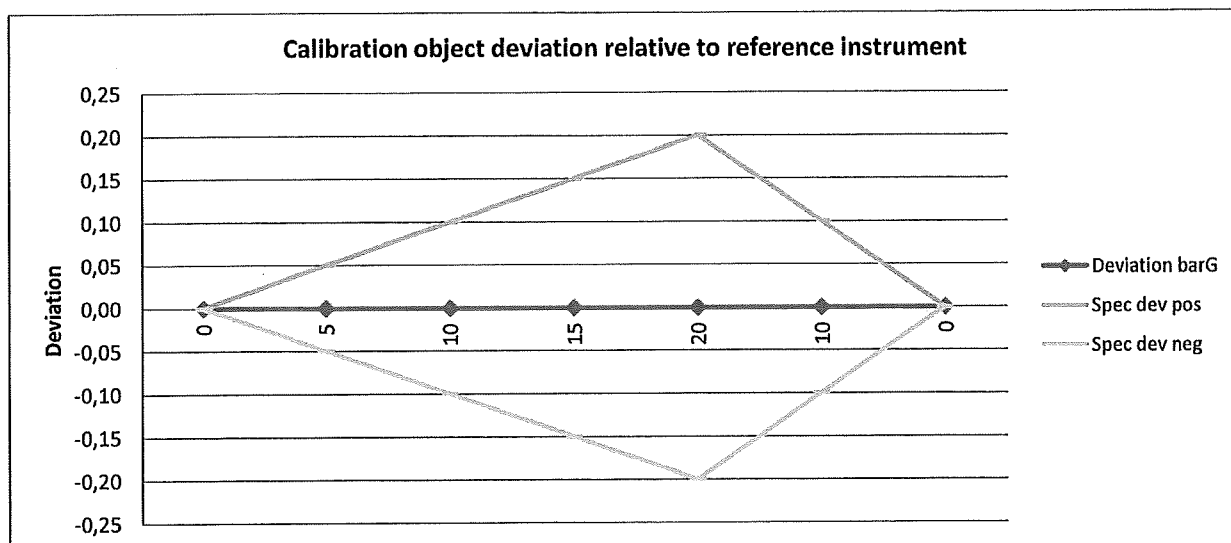
Certificate of calibration		 FRAMO an Alfa Laval brand	
		Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Oilflow turbinemeter	Calibrator:	Turbinemeter
Test instrument:	RY3 Cargo	Type:	Flow Technology
Serial no:	3204672	Model:	FT40
Range:	0-800	Range:	0-1500l/min
Unit:	l/min	Serial no:	4001315
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	Jon Alfheim		
Date:	27.01.2016	Offset	800
Valid through:	jan. 17	Gain	1000
Approved by:	O.J.Gjerde	<i>Ole Gjerde</i>	
			
Calibration object	Calibrator	Deviation	Deviation
READOUT	READOUT	l/min	%
0,0	0,0	0,0	
120,0	120,0	0,0	0,00
145,0	144,0	1,0	0,69
202,0	200,0	2,0	1,00
239,0	237,0	2,0	0,84
299,0	297,0	2,0	0,67
415,0	415,0	0,0	0,00
543,0	544,0	-1,0	-0,18
0,0	0,0	0,0	
Cal temperature (deg C) 42		Max deviation:	1,00




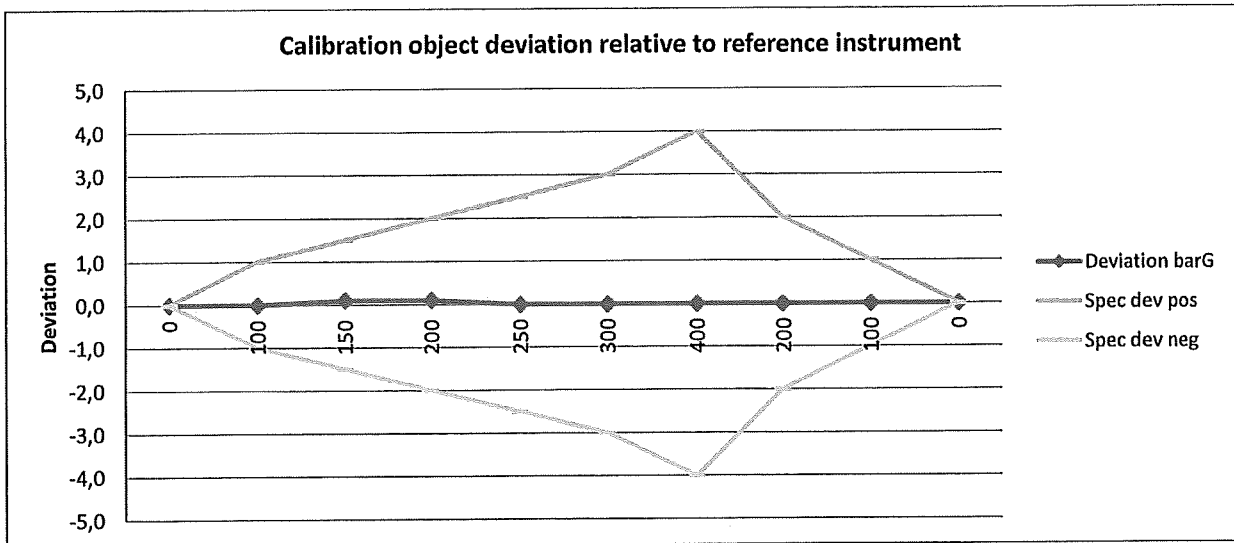
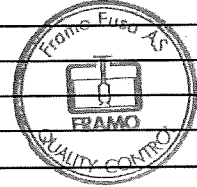
Certificate of calibration		 Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Pressure transmitter	Calibrator:	Digital Pressure Calibrator
Test instrument:	HT RY3C	Type:	CRYSTAL
Serial no:	8462174	Model:	XP2i
Range:	1,1-256,5	Range:	0-30 bar
Unit:	mlc	Serial no:	069283
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	K. Aakre		
Date:	30.12.2015	Offset	797
Valid through:	des. 16	Gain	999
Approved by:	O. J. Gjerde	<i>Ole A Gjerde</i>	
Calibration object	Calibrator	Deviation	Deviation
READOUT	LOAD	mlc	%
1,1	0,0	0,0	
52,2	51,0	0,1	0,20
103,3	102,1	0,1	0,10
154,4	153,2	0,1	0,07
205,5	204,3	0,1	0,05
256,6	255,4	0,1	0,04
154,3	153,2	0,0	0,00
52,1	51,0	0,0	0,00
1,1	0,0	0,0	
NOTE!			
Calibration object is placed 1,1 meters above water level in testwell			
and readout of calibration object is adjusted accordingly.			
Cal temperature (deg C) 18,5		Max deviation:	0,20


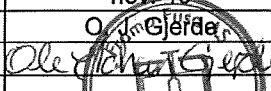



Certificate of calibration		 Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Pressure transmitter	Calibrator:	Digital Pressure Calibrator
Test instrument:	PR RY3C	Type:	CRYSTAL
Serial no:	SN 302277 -004	Model:	XP2i
Range:	0-20	Range:	0-700 bar
Unit:	barG	Serial no:	651629
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	K. Aakre		
Date:	30.12.2015	Offset	720
Valid through:	des. 16	Gain	1010
Approved by:	O. J. Gjerde	<i>Ole J. Gjerde</i>	
Calibration object	Calibrator	Deviation	Deviation
READOUT	LOAD	barG	%
0,0	0,0	0,0	
5,0	5,0	0,0	0,00
10,0	10,0	0,0	0,00
15,0	15,0	0,0	0,00
20,0	20,0	0,0	0,00
10,0	10,0	0,0	0,00
0,0	0,0	0,0	
Cal temperature (deg C) 20,8		Max deviation:	0,00



Certificate of calibration		 Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Pressure transmitter	Calibrator:	Digital Pressure Calibrator
Test instrument:	PT RY3C	Type:	CRYSTAL
Serial no:	SN 2996612-002	Model:	XP2i
Range:	0-400	Range:	0-700 bar
Unit:	barG	Serial no:	651629
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	K. Aakre		
Date:	30.12.2015	Offset	790
Valid through:	des. 16	Gain	997
Approved by:	O. J. Gjerde	<i>Ole J. Gjerde</i>	
Calibration object	Calibrator	Deviation	Deviation
READOUT	LOAD	barG	%
0,0	0,0	0,0	
100,0	100,0	0,0	0,00
150,1	150,0	0,1	0,07
200,1	200,0	0,1	0,05
250,0	250,0	0,0	0,00
300,0	300,0	0,0	0,00
400,0	400,0	0,0	0,00
200,0	200,0	0,0	0,00
100,0	100,0	0,0	0,00
0,0	0,0	0,0	
Cal temperature (deg C) 21,4		Max deviation:	0,07



Certificate of calibration		 FRAMO <small>an Alfa Laval brand</small>	
		Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	MAG5100W DN250	Calibrator:	Magflo Verificator
Test instrument:	RB3	Operated by:	Axflow
Serial no:	111402H312		
Range:	0-800	Reference to external Verification Certificate	
Unit:	m3h		
Accuracy :<	1,0 %		
Cal freq (months)	12		
Operator:	P Rasmussen (external)		
Date:	20.11.2015		
Valid through:	nov. 16		
Approved by:	Ole Gjerde		
		Offset	800
		Gain	1000

SIEMENS MAGFLO® Verification Certificate

Customer:		MAGFLO® Identification:	
Name	Frank Mohn	TAG No./Name	0
Address	Fusa	Sensor Code No.	7ME65204VC132AA1
		Sensor Serial No.	111402H312
		Transmitter Code No.	7ME692
Phone		Transmitter Serial No.	N1C6064243
Email		Location	RB3

Results:		Verification file name or No.	File #3
	Transmitter		Passed
	Sensor Insulation		Passed
	Magnetic Circuit		Passed

Velocity	Current Output			Frequency Output		
	Theoretical	Actual	Deviation	Theoretical	Actual	Deviation
0,5m/s	4,800mA	4,799mA	-0,17%	0,500kHz	0,497kHz	-0,52%
1,0m/s	5,600mA	5,604mA	0,25%	1,000kHz	1,001kHz	0,11%
3,0m/s	8,800mA	8,808mA	0,18%	3,000kHz	3,005kHz	0,18%

Current Output 4-20mA Frequency Output 0-10kHz

Transmitter Settings:		
Basic	Qmax.	799,99: m³ /h
	Flow Direction	Positive
	Low flow Cut-off	1,50%
	Empty Pipe	OFF
Output	Current Output	ON (4-20mA)
	Time Constant	5,0 Sec.
	Relay Output	Error Level
	Digital Output	Pulse
	Frequency Range	N/A
	Time Constant	N/A
	Volume/pulse	1,0 m³/p
	Pulse width	0,066 sec.
	Pulse polarity	Positiv
	Totalizer 1 value before test	793051,0 m³
Totalizer 1 value after test	793051,0625 m³	
Totalizer 2 value before test	18784,35742188 m³	
Totalizer 2 value after test	18784,35742188 m³	
Operating time in days	1139	

Sensor Details:	
Size	DN 250 10 IN
Cal. Factor	42,98632431
Correction Factor	1,0
Excitation Freq.	3,125Hz

Vericator Details (083F5060)	
Serial No.	N1ED220002
Device No.	150004
Software Version	1.40
PC-Software Version	5.01
Cal. date	2015.01.23
ReCal. date	2016.01.23


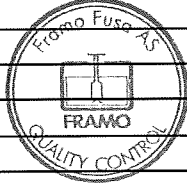
Comments

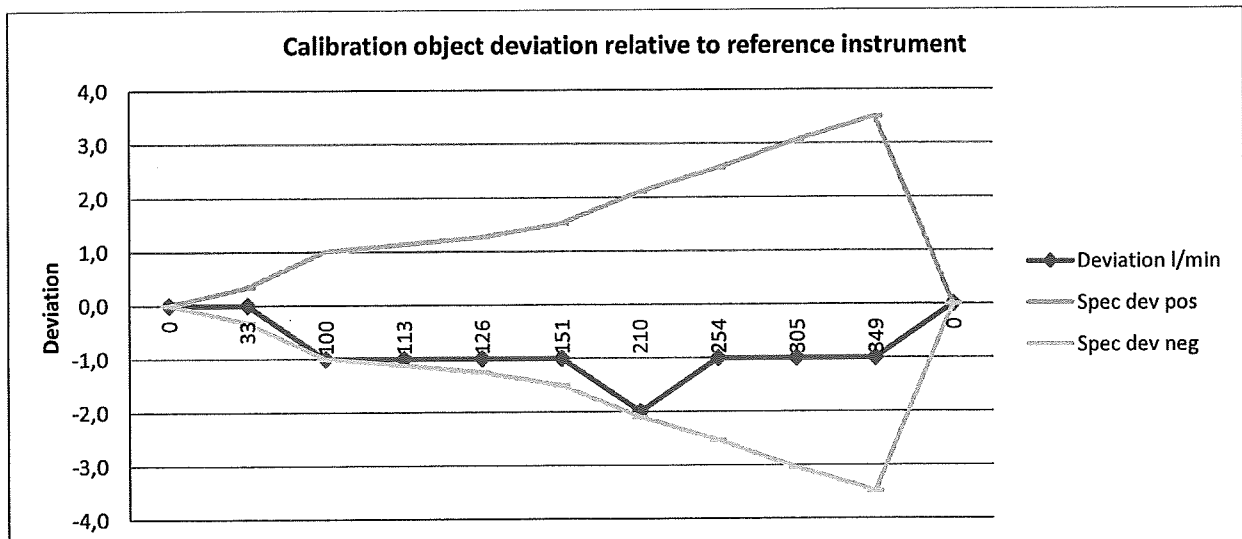
These tests verify that the flowmeter is functioning within 2% deviation of the original test parameters...


Verification is traceable to National and International Standards.

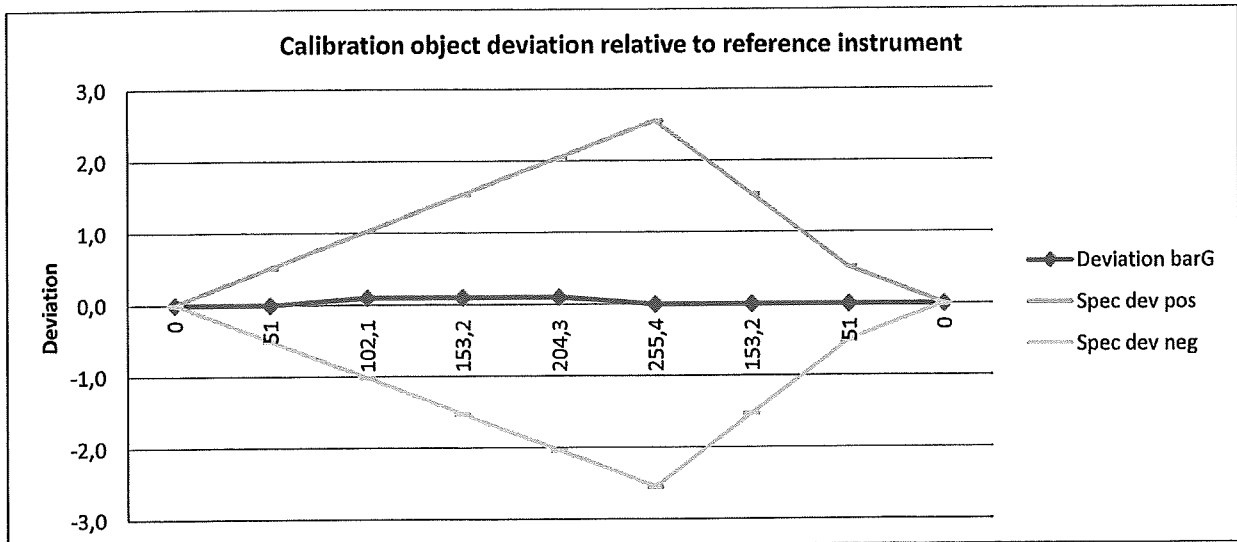
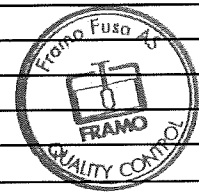
Date and signature 20/11/2015
2015.11.20


AXFLOW AS
Lilleakerveien 10
Postboks 98 Lilleaker
4402 Østbyen
Paal-Andre Havn
Lilleakerveien 14

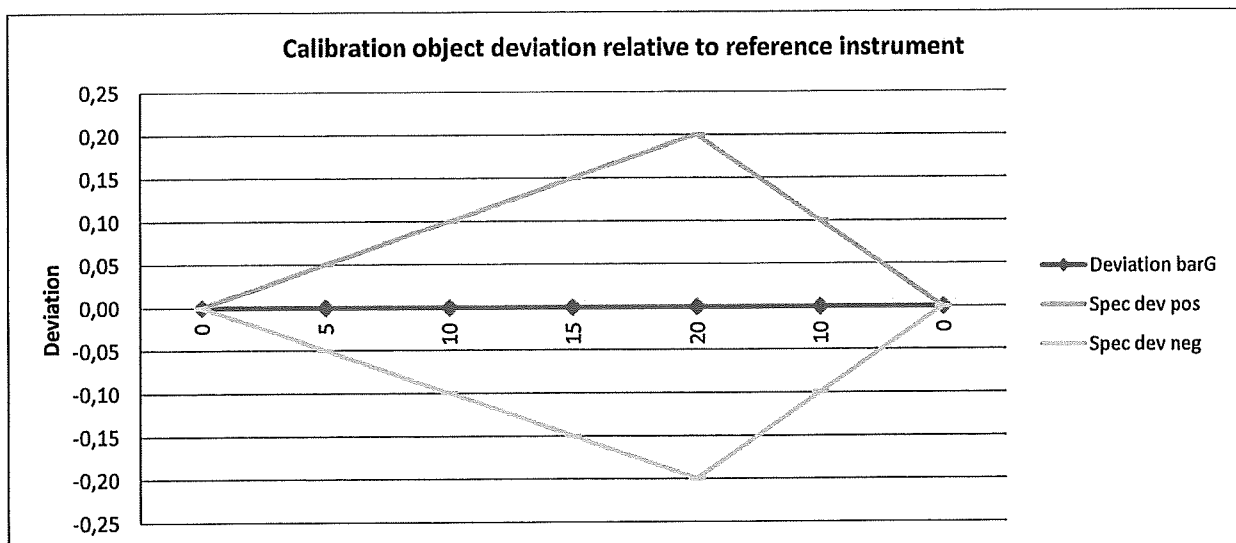
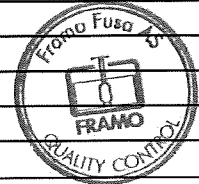
Certificate of calibration		 FRAMO an Alfa Laval brand	
		Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Oilflow turbinemeter	Calibrator:	Turbinemeter
Test instrument:	RY5 Cargo	Type:	Flow Technology
Serial no:	2405982	Model:	FT40
Range:	0-570	Range:	0-1500l/min
Unit:	l/min	Serial no:	4001315
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	Jon Alfheim		
Date:	27.01.2016	Offset	800
Valid through:	jan. 17	Gain	1000
Approved by:	O.J.Gjerde	<i>O.J.Gjerde</i>	
			
Calibration object	Calibrator	Deviation	Deviation
READOUT	READOUT	l/min	%
0,0	0,0	0,0	
33,0	33,0	0,0	0,00
99,0	100,0	-1,0	-1,00
112,0	113,0	-1,0	-0,88
125,0	126,0	-1,0	-0,79
150,0	151,0	-1,0	-0,66
208,0	210,0	-2,0	-0,95
253,0	254,0	-1,0	-0,39
304,0	305,0	-1,0	-0,33
348,0	349,0	-1,0	-0,29
0,0	0,0	0,0	
Cal temperature (deg C) 42		Max deviation:	-1,00





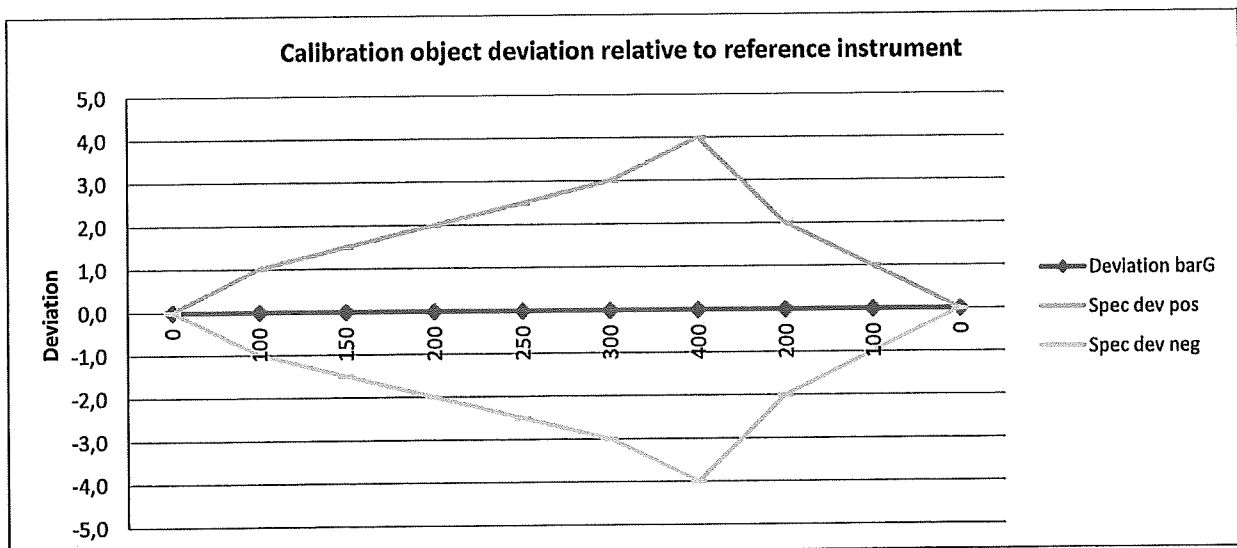
Certificate of calibration		 Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Pressure transmitter	Calibrator:	Digital Pressure Calibrator
Test instrument:	HT RY5C	Type:	CRYSTAL
Serial no:	8462175	Model:	XP2i
Range:	1,1-256,5	Range:	0-30 bar
Unit:	mlc	Serial no:	069283
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	K. Aakre		
Date:	30.12.2015	Offset	800
Valid through:	des. 16	Gain	999
Approved by:	O. J. Gjerde	<i>Ole A. Gjerde</i>	
Calibration object	Calibrator	Deviation	Deviation
READOUT	LOAD	mlc	%
1,1	0,0	0,0	
52,1	51,0	0,0	0,00
103,3	102,1	0,1	0,10
154,4	153,2	0,1	0,07
205,5	204,3	0,1	0,05
256,5	255,4	0,0	0,00
154,3	153,2	0,0	0,00
52,1	51,0	0,0	0,00
1,1	0,0	0,0	
NOTE!			
Calibration object is placed 1,1 meters above water level in testwell			
and readout of calibration object is adjusted accordingly.			
Cal temperature (deg C) 18,5		Max deviation:	0,10




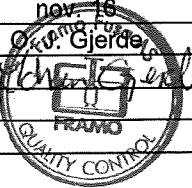
Certificate of calibration		 Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Pressure transmitter	Calibrator:	Digital Pressure Calibrator
Test instrument:	PR RY5C	Type:	CRYSTAL
Serial no:	SN 302277-001	Model:	XP2i
Range:	0-20	Range:	0-700 bar
Unit:	barG	Serial no:	651629
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	K. Aakre		
Date:	30.12.2015	Offset	790
Valid through:	des. 16	Gain	1080
Approved by:	O. J. Gjerde	<i>O. J. Gjerde</i>	
Calibration object	Calibrator	Deviation	Deviation
READOUT	LOAD	barG	%
0,0	0,0	0,0	
5,0	5,0	0,0	0,00
10,0	10,0	0,0	0,00
15,0	15,0	0,0	0,00
20,0	20,0	0,0	0,00
10,0	10,0	0,0	0,00
0,0	0,0	0,0	
Cal temperature (deg C) 18,2		Max deviation:	0,00



Certificate of calibration		 Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Pressure transmitter	Calibrator:	Digital Pressure Calibrator
Test instrument:	PT RY5C	Type:	CRYSTAL
Serial no:	SN 310798-001	Model:	XP2i
Range:	0-400	Range:	0-700 bar
Unit:	barG	Serial no:	651629
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	K. Aakre		
Date:	30.12.2015	Offset	790
Valid through:	des. 16	Gain	1002
Approved by:	O. J. Gjerde	<i>Ole J. Gjerde</i>	
			
Calibration object	Calibrator	Deviation	Deviation
READOUT	LOAD	barG	%
0,0	0,0	0,0	
100,0	100,0	0,0	0,00
150,0	150,0	0,0	0,00
200,0	200,0	0,0	0,00
250,0	250,0	0,0	0,00
300,0	300,0	0,0	0,00
400,0	400,0	0,0	0,00
200,0	200,0	0,0	0,00
100,0	100,0	0,0	0,00
0,0	0,0	0,0	
Cal temperature (deg C) 21,3		Max deviation:	0,00



Certificate of calibration		 FRAMO an Alfa Laval brand Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	MAG5100W DN150	Calibrator:	Magflo Verificator
Test instrument:	RB5	Operated by:	Axflow
Serial no:	244302H025		
Range:	0-500	Reference to external Verification Certificate	
Unit:	m3h		
Accuracy :<	1,0 %		
Cal freq (months)	12		
Operator:	P Rasmussen (external)		
Date:	20.11.2015		
Valid through:	nov. 16		
Approved by:	<i>Ole Gjerde</i>		
		Offset	800
		Gain	1000



SIEMENS MAGFLO® Verification Certificate

Customer:		MAGFLO® Identification:	
Name	Frank Mohn	TAG No./Name	0
Address	Fusa	Sensor Code No.	7ME65204HC132A
		Sensor Serial No.	244302H025
		Transmitter Code No.	7ME692
Phone		Transmitter Serial No.	N1C6064364
Email		Location	RB5

Results:	Verification file name or No.	File #5
	Transmitter	Passed
	Sensor Insulation	Passed
	Magnetic Circuit	Passed

Velocity	Current Output			Frequency Output		
Theoretical	Theoretical	Actual	Deviation	Theoretical	Actual	Deviation
0,5m/s	4,800mA	4,803mA	0,34%	0,500kHz	0,501kHz	0,13%
1,0m/s	5,600mA	5,602mA	0,15%	1,000kHz	1,001kHz	0,08%
3,0m/s	8,800mA	8,804mA	0,08%	3,000kHz	3,003kHz	0,11%

Current Output 4-20mA Frequency Output 0-10kHz

Transmitter Settings:		
Basic	Qmax.	500,000 m³ /h
	Flow Direction	Positive
	Low flow Cut-off	1,50%
	Empty Pipe	OFF
Output	Current Output	ON (4-20mA)
	Time Constant	5,0 Sec.
	Relay Output	Error Level
	Digital Output	Pulse
	Frequency Range	N/A
	Time Constant	N/A
	Volume/pulse	100,0 l/p
	Pulse width	0,066 sec.
	Pulse polarity	Positiv
	Totalizer 1 value before test	70840,28125 m³
	Totalizer 1 value after test	70840,3125 m³
	Totalizer 2 value before test	871,43157959 m³
	Totalizer 2 value after test	871,43157959 m³
	Operating time in days	1175

Sensor Details:	
Size	DN 150 6 IN
Cal. Factor	14,45251656
Correction Factor	1,0
Excitation Freq.	6,25Hz


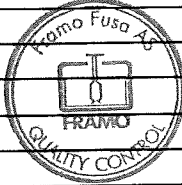
Vericator Details (083F5060)	
Serial No.	N1ED220002
Device No.	150004
Software Version	1.40
PC-Software Version	5.01
Cal. date	2015.01.23
ReCal. date	2016.01.23

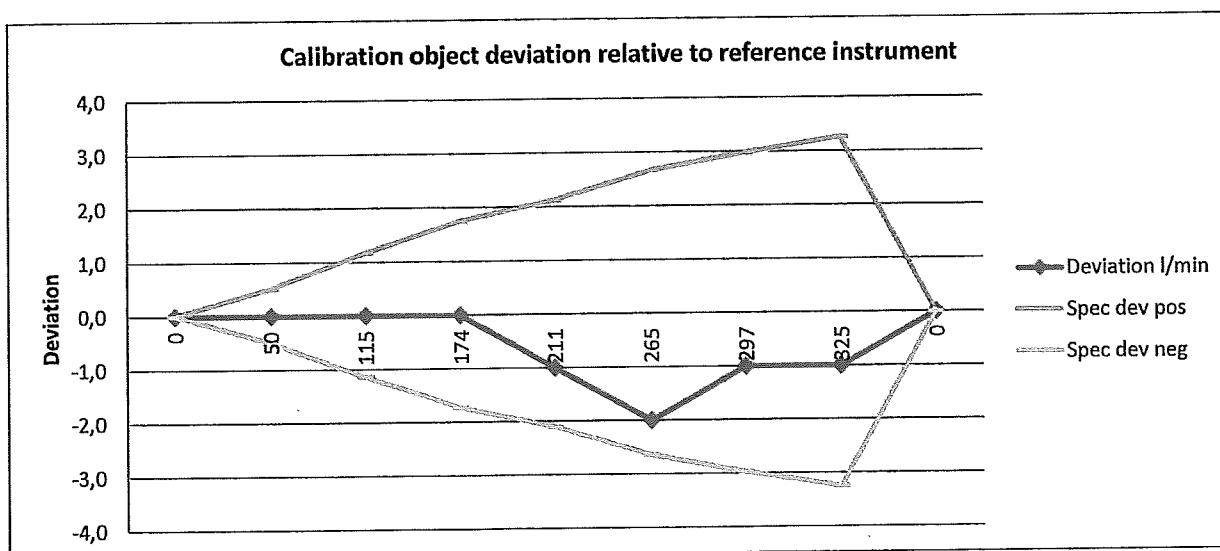
Comments


These tests verify that the flowmeter is functioning within 2% deviation of the original test parameters.
 Verification is traceable to National and International Standards.

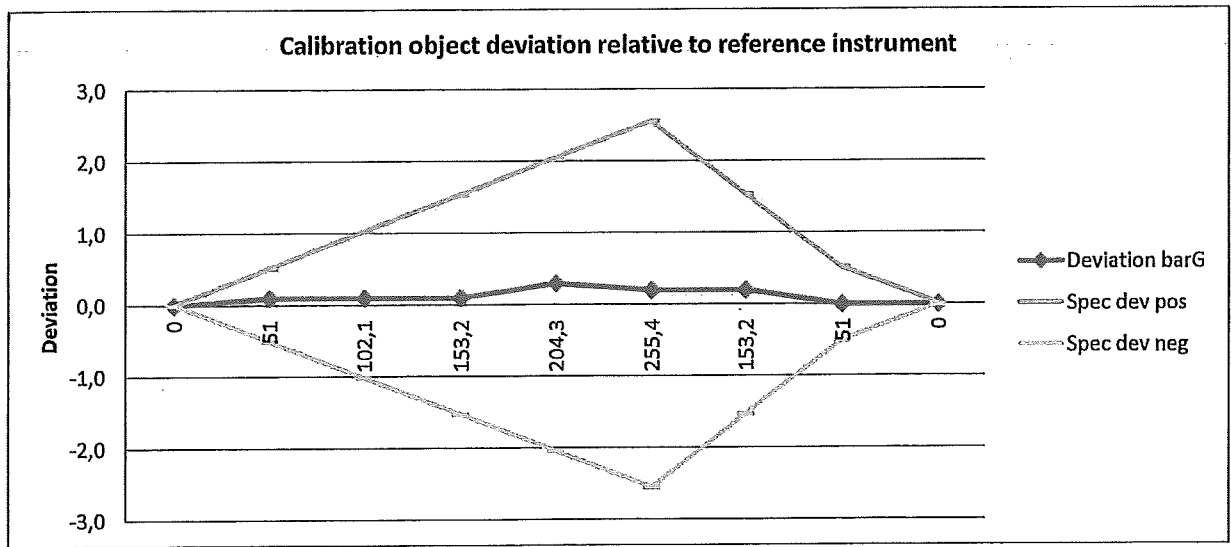
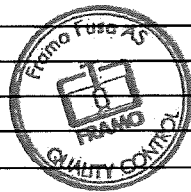
Date and signature 20/11/2015
 2015.11.20


AXFLOWAS
 Lilleakerveien 10
 Postboks 98 Lilleaker
 0403 OSLO
 Paal-Andre Rasmussen
 Lilleakerveien 14

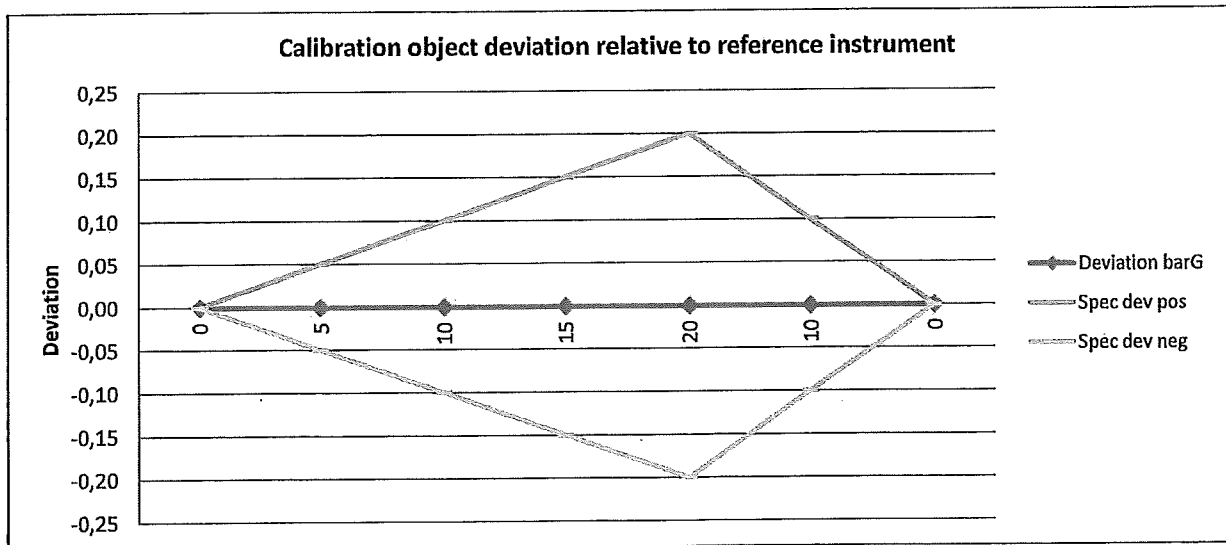
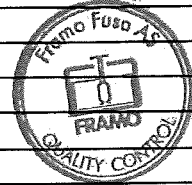
Certificate of calibration		 FRAMO an Alfa Laval brand	
		Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Oilflow turbinemeter	Calibrator:	Turbinemeter
Test instrument:	RY6 Cargo	Type:	Flow Technology
Serial no:	2405986	Model:	FT40
Range:	0-570	Range:	0-1500l/min
Unit:	l/min	Serial no:	4001315
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	Jon Alfheim		
Date:	27.01.2016	Offset	800
Valid through:	jan. 17	Gain	1000
Approved by:	O.J.Gjerde	<i>O.J.Gjerde</i>	
			
Calibration object	Calibrator	Deviation	Deviation
READOUT	READOUT	l/min	%
0,0	0,0	0,0	
50,0	50,0	0,0	0,00
115,0	115,0	0,0	0,00
174,0	174,0	0,0	0,00
210,0	211,0	-1,0	-0,47
263,0	265,0	-2,0	-0,75
296,0	297,0	-1,0	-0,34
324,0	325,0	-1,0	-0,31
0,0	0,0	0,0	
Cal temperature (deg C) 42		Max deviation:	-0,75




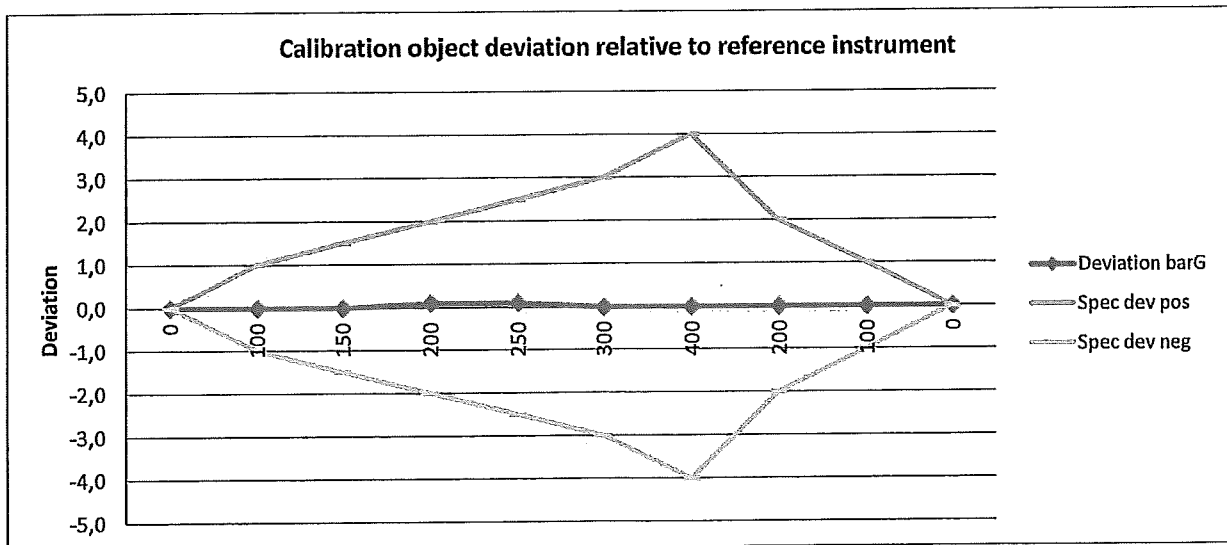
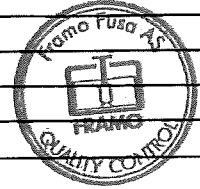
Certificate of calibration		 Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Pressure transmitter	Calibrator:	Digital Pressure Calibrator
Test instrument:	HT RY6C	Type:	CRYSTAL
Serial no:	8462176	Model:	XP2i
Range:	1,1-256,5	Range:	0-30 bar
Unit:	mlc	Serial no:	069283
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	K. Aakre		
Date:	30.12.2015	Offset	805
Valid through:	des. 16	Gain	1001
Approved by:	O. J. Gjerde	<i>Ole J. Gjerde</i>	
Calibration object	Calibrator	Deviation	Deviation
READOUT	LOAD	mlc	%
1,1	0,0	0,0	
52,2	51,0	0,1	0,20
103,3	102,1	0,1	0,10
154,4	153,2	0,1	0,07
205,7	204,3	0,3	0,15
256,7	255,4	0,2	0,08
154,5	153,2	0,2	0,13
52,1	51,0	0,0	0,00
1,1	0,0	0,0	
NOTE!			
Calibration object is placed		1,1	meters above water level in testwell
and readout of calibration object is adjusted accordingly.			
Cal temperature (deg C) 18,3		Max deviation:	0,20





Certificate of calibration		 FRAMO an Alfa Laval brand	
		Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Pressure transmitter	Calibrator:	Digital Pressure Calibrator
Test instrument:	PR RY6C	Type:	CRYSTAL
Serial no:	278319-004	Model:	XP2i
Range:	0-20	Range:	0-700 bar
Unit:	barG	Serial no:	651629
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	K. Aakre		
Date:	30.12.2015	Offset	800
Valid through:	des. 16	Gain	1040
Approved by:	O. J. Gjerde	<i>O. J. Gjerde</i>	
Calibration object	Calibrator	Deviation	Deviation
READOUT	LOAD	barG	%
0,0	0,0	0,0	
5,0	5,0	0,0	0,00
10,0	10,0	0,0	0,00
15,0	15,0	0,0	0,00
20,0	20,0	0,0	0,00
10,0	10,0	0,0	0,00
0,0	0,0	0,0	
Cal temperature (deg C) 18,2		Max deviation:	0,00



Certificate of calibration		 Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	Pressure transmitter	Calibrator:	Digital Pressure Calibrator
Test instrument:	PT RY6C	Type:	CRYSTAL
Serial no:	SN 360307-001	Model:	XP2i
Range:	0-400	Range:	0-700 bar
Unit:	barG	Serial no:	651629
Accuracy :<	1,0 %	Accuracy :<	0,05%
Cal freq (months)	12		
Operator:	K. Aakre		
Date:	30.12.2015	Offset	800
Valid through:	des. 16	Gain	1002
Approved by:	O. J. Gjerde	<i>Ole J. Gjerde</i>	
Calibration object	Calibrator	Deviation	Deviation
READOUT	LOAD	barG	%
0,0	0,0	0,0	
100,0	100,0	0,0	0,00
150,0	150,0	0,0	0,00
200,1	200,0	0,1	0,05
250,1	250,0	0,1	0,04
300,0	300,0	0,0	0,00
400,0	400,0	0,0	0,00
200,0	200,0	0,0	0,00
100,0	100,0	0,0	0,00
0,0	0,0	0,0	
Cal temperature (deg C) 21,3		Max deviation:	0,05



Certificate of calibration		 FRAMO <small>an Alfa Laval brand</small>	
		Framo Fusa AS, NO-5641 Fusa, Norway	
Instrument type:	MAG5100W DN150	Calibrator:	Magflo Verificator
Test instrument:	RB6	Operated by:	Axflow
Serial no:	313902H025		
Range:	0-500	Reference to external Verification Certificate	
Unit:	m3h		
Accuracy :<	1,0 %		
Cal freq (months)	12		
Operator:	P Rasmussen (external)		
Date:	20.11.2015		
Valid through:	nov-16		
Approved by:	<i>Olof Peter Gjerd</i>		
		Offset	800
		Gain	1000

SIEMENS MAGFLO® Verification Certificate

Customer:		MAGFLO® Identification:	
Name	Frank Mohn	TAG No./Name	0
Address	Fusa	Sensor Code No.	7ME65204HC132A
		Sensor Serial No.	313902H025
		Transmitter Code No.	7ME692
Phone		Transmitter Serial No.	N1C6064299
Email		Location	RB6

Results:	Verification file name or No.	File #6
	Transmitter	Passed
	Sensor Insulation	Passed
	Magnetic Circuit	Passed

Velocity	Current Output			Frequency Output		
	Theoretical	Actual	Deviation	Theoretical	Actual	Deviation
0,5m/s	4,800mA	4,802mA	0,28%	0,500kHz	0,499kHz	-0,11%
1,0m/s	5,600mA	5,601mA	0,09%	1,000kHz	0,999kHz	-0,07%
3,0m/s	8,800mA	8,796mA	-0,09%	3,000kHz	2,997kHz	-0,09%

Current Output 4-20mA Frequency Output 0-10kHz

Transmitter Settings:		
Basic	Qmax.	500,000 m³ /h
	Flow Direction	Positive
	Low flow Cut-off	1,50%
	Empty Pipe	OFF
Output	Current Output	ON (4-20mA)
	Time Constant	5,0 Sec.
	Relay Output	Error Level
	Digital Output	Pulse
	Frequency Range	N/A
	Time Constant	N/A
	Volume/pulse	100,0 l/p
	Pulse width	0,066 sec.
	Pulse polarity	Positiv
	Totalizer 1 value before test	71390,015625 m³
	Totalizer 1 value after test	71390,046875 m³
	Totalizer 2 value before test	695,71942139 m³
	Totalizer 2 value after test	695,71942139 m³
	Operating time in days	1173

Sensor Details:	
Size	DN 150 6 IN
Cal. Factor	14,73915291
Correction Factor	1,0
Excitation Freq.	6,25Hz

Vericator Details (083F5060)	
Serial No.	N1ED220002
Device No.	150004
Software Version	1.40
PC-Software Version	5.01
Cal. date	2015.01.23
ReCal. date	2016.01.23

Comments

These tests verify that the flowmeter is functioning within 2% deviation of the original test parameters.

Verification is traceable to National and International Standards.

Date and signature 20/11/2015
2015.11.20

AXFLOW AS
Lilleakerveien 10
Postboks 98 Lilleaker
0403 Lilleaker
Paal-Andre Hassel
Lilleakerveien 14

**TEST PROTOCOL FOR
STANDARD HYDRAULICALLY
DRIVEN PUMPS**



附件三

ORDER DATA:

Order no.: 617600 # 40	Shipyard: CSBC Corp, Taiwan
No of pumps: 1	Yard no.: 1053
Pump code: TK100 DUHH32-A178	Class: BV
Pump spec.: 0115-1742-403	Stamped: BV 114683 16
Material casing: EN1.4432	Cert. no. hose (TK-pump):
Material shaft: EN1.8507	
Material impeller: EN1.4432	

SPECIFIED TEST DATA:

Capacity: 150 m ³ /h	Oil consumption: 145 l/min.
Head: 70 mwc	Hydr. pressure: 230 bar
Power: 53,0 kW	Speed: 4356 rpm
Test medium: Fresh water	

RECORDED DATA:

Pump no.	Capacity	Discharge head	Suction head	Oil consum.	Hydraulic pressure	Return pressure	Motor no.
	Q TP1	Hd TP2	Hs TP6	q TP5	Pp TP3	Pr TP4	
	m ³ /h	mlc	mlc	l/min	bar	bar	
114683	150	70		141	0.10	1.0	

CLASS DATA:

Capacity	Discharge Head	Average Oil consume	Average Δ P	Average Power
m ³ /h	mlc	l/min	bar	kW
150	70	0	0	0,0

Witnessed by	Sign.	Date
Test Engineer	<i>M. A. Noel</i>	07.03.2016
Witnessed		
Witnessed		

These final test results are to be complied with the approved drawings issued by Framo.

Framo 3/8/2016
3/8/2016

**TEST PROTOCOL FOR
STANDARD HYDRAULICALLY
DRIVEN PUMPS**



ORDER DATA:

Order no.:	617600 # 112	Shipyard:	CSBC Corp, Taiwan
No of pumps:	2	Yard no.:	1053
Pump code:	SD150-6 DTHH107-B315	Class:	BV
Pump spec.:	0115-1742-402	Stamped:	BV 114684-114685 16
Material casing:	EN1.4432		
Material shaft:	EN1.6582		
Material impeller:	CF3M+Mo		

SPECIFIED TEST DATA:

Capacity:	268 m ³ /h	Oil consumption:	289 l/min.
Head:	100 mwc	Hydr. pressure:	221 bar
Power:	97,0 kW	Speed:	2619 rpm
Test medium:	Fresh water		

RECORDED DATA:

Pump no.	Capacity	Discharge head	Suction head	Oil consum.	Hydraulic pressure	Return pressure	Motor no.
	Q	Hd	Hs	q	Pp	Pr	
	TP1 m ³ /h	TP2 mlc	TP6 mlc	TP5 l/min	TP3 bar	TP4 bar	
114684	268	100		285	218	2.0	29380078
114685	268	100		284	219	3.0	0080
114685	0	130		323	98	3.0	

CLASS DATA:

Capacity	Discharge Head	Average Oil consume	Average Δ P	Average Power
m ³ /h	mlc	l/min	bar	kW
268	100	0	0	0,0

Witnessed by	Sign.	Date
Test Engineer	<i>Nils-Andri Weiskopf</i>	07.03.2016
Witnessed		
Witnessed		

These final test results are to be complied with the approved drawings issued by Framo.

*File 5
3/8/2016
黃成/張 3/8/2016*

**TEST PROTOCOL FOR
STANDARD HYDRAULICALLY
DRIVEN PUMPS**



ORDER DATA:

Order no.:	617600 # 132	Shipyards:	CSBC Corp, Taiwan
No of pumps:	10	Yard no.:	1053
Pump code:	SD200-6 DTHH200-C347	Class:	BV
Pump spec.:	0115-1742-401	Stamped:	BV 114686-114695 16
Material casing:	EN1.4432		
Material shaft:	EN1.6582		
Material impeller:	CF3M+Mo		

SPECIFIED TEST DATA:

Capacity:	537 m ³ /h	Oil consumption:	510 l/min.
Head:	100 mwc	Hydr. pressure:	255 bar
Power:	193,0 kW	Speed:	2461 rpm
Test medium:	Fresh water		

RECORDED DATA:

Ry2
Ry3
Ry3
Ry2
Ry3
Ry2
Ry3
Ry2
Ry3
Ry2
Ry3
Ry2

Pump no.	Capacity	Discharge head	Suction head	Oil consum.	Hydraulic pressure	Return pressure	Motor no.
	Q TP1 m ³ /h	Hd TP2 mlc	Hs TP6 mlc	q TP5 l/min	Pp TP3 bar	Pr TP4 bar	
114686	537	100		507	261	5.0	34554873
114687	537	100		502	259	4.0	34554884
114688	537	100		505	264	5.0	34554885
114689	537	100		504	260	5.0	34554888
114690	537	100		504	258	5.0	34554868
114691	537	100		506	259	5.0	34554872
114692	537	100		506	263	5.0	34554886
114693	537	100		504	260	5.0	34554887
114694	537	100		509	257	5.0	34554876
114695	537	100		500	257	5.0	34554875
114695	0	155		570	158	5.0	—

CLASS DATA:

Capacity	Discharge Head	Average Oil consume	Average Δ P	Average Power
m ³ /h	mlc	l/min	bar	kW
537	100	0	0	0,0

Witnessed by	Sign.	Date
Test Engineer	<i>N.A. Neel</i>	07.03.2016
Witnessed		
Witnessed		

These final results are to be complied with the approved drawings issued by Framo.

F. S. G.
3/8/2016
[Signature]
3/8/2016

**TEST PROTOCOL FOR
STANDARD HYDRAULICALLY
DRIVEN PUMPS**



ORDER DATA:

Order no.:	617600 # 133	Shipyard:	CSBC Corp, Taiwan
No of pumps:	2	Yard no.:	1053
Pump code:	SD200-6 DTHH200-C347	Class:	BV
Pump spec.:	0115-1742-407	Stamped:	
Material casing:	EN1.4432		
Material shaft:	EN1.6582		
Material impeller:	CF3M+Mo		

SPECIFIED TEST DATA:

Capacity:	537 m ³ /h	Oil consumption:	510 l/min.
Head:	100 mwc	Hydr. pressure:	255 bar
Power:	193,0 kW	Speed:	2461 rpm
Test medium:	Fresh water		

RECORDED DATA:

R3

Pump no.	Capacity	Discharge head	Suction head	Oil consum.	Hydraulic pressure	Return pressure	Motor no.
	Q TP1	Hd TP2	Hs TP6	q TP5	Pp TP3	Pr TP4	
	m ³ /h	mlc	mlc	l/min	bar	bar	
114696	537	100		502	259	5.0	34554870
114697	537	100		501	259	5.0	34554871
114697	0	154		570	158	5.0	—

CLASS DATA:

Capacity	Discharge Head	Average Oil consume	Average Δ P	Average Power
m ³ /h	mlc	l/min	bar	kW
537	100	0	0	0,0

Witnessed by	Sign.	Date
Test Engineer	<i>N.A. Nerd</i>	08.03.2016
Witnessed		
Witnessed		

The final test results are to be compiled with the approved drawings issued by Framo.

Handwritten notes:
 李成良 3/8/2016
 李成良 3/8/2016

**TEST PROTOCOL FOR
STANDARD HYDRAULICALLY
DRIVEN PUMPS**



ORDER DATA:

Order no.:	617601 # 40	Shipyard:	CSBC Corp, Taiwan
No of pumps:	1	Yard no.:	1054
Pump code:	TK100 DUHH32-A178	Class:	BV
Pump spec.:	0115-1742-403	Stamped:	BV 114698 16
Material casing:	EN1.4432	Cert. no. hose (TK-pump):	
Material shaft:	EN1.8507		
Material impeller:	EN1.4432		

SPECIFIED TEST DATA:

Capacity:	150 m ³ /h	Oil consumption:	145 l/min.
Head:	70 mwc	Hydr. pressure:	230 bar
Power:	53,0 kW	Speed:	4356 rpm
Test medium:	Fresh water		

RECORDED DATA:

Pump no.	Capacity	Discharge head	Suction head	Oil consum.	Hydraulic pressure	Return pressure	Motor no.
	Q TP1	Hd TP2	Hs TP6	q TP5	Pp TP3	Pr TP4	
	m ³ /h	mlc	mlc	l/min	bar	bar	
114698	150	70		140	216	1.0	

CLASS DATA:

Capacity	Discharge Head	Average Oil consume	Average Δ P	Average Power
m ³ /h	mlc	l/min	bar	kW
150	70	0	0	0,0

Witnessed by	Sign.	Date
Test Engineer	<i>[Signature]</i>	07.03.2016
Witnessed		
Witnessed		

These final test results are to be complied with the approved drawings issued by Framo.

[Signature] 3/8/2016
[Signature] 3/8/2016

**TEST PROTOCOL FOR
STANDARD HYDRAULICALLY
DRIVEN PUMPS**



ORDER DATA:

Order no.:	617601 # 112	Shipyard:	CSBC Corp, Taiwan
No of pumps:	2	Yard no.:	1054
Pump code:	SD150-6 DTHH107-B315	Class:	BV
Pump spec.:	0115-1742-402	Stamped:	BV 114699-114700 16
Material casing:	EN1.4432		
Material shaft:	EN1.6582		
Material impeller:	CF3M+Mo		

SPECIFIED TEST DATA:

Capacity:	268 m ³ /h	Oil consumption:	289 l/min.
Head:	100 mwc	Hydr. pressure:	221 bar
Power:	97,0 kW	Speed:	2619 rpm
Test medium:	Fresh water		

RECORDED DATA:

Pump no.	Capacity	Discharge head	Suction head	Oil consum.	Hydraulic pressure	Return pressure	Motor no.
	Q	Hd	Hs	q	Pp	Pr	
	TP1 m ³ /h	TP2 mlc	TP6 mlc	TP5 l/min	TP3 bar	TP4 bar	
114699	268	100		285	220	3.0	29398940
114700	268	100		285	224	5.0	29398941
114700	0	131		323	102	5.0	

CLASS DATA:

Capacity	Discharge Head	Average Oil consume	Average Δ P	Average Power
m ³ /h	mlc	l/min	bar	kW
268	100	0	0	0,0

Witnessed by	Sign.	Date
Test Engineer	<i>Nils-André Nord</i>	07.03.2016
Witnessed		
Witnessed		

The final test results are to be complied with the approved drawings issued by Framo.

Framo 3/8/2016
黃成 3/8/2016

**TEST PROTOCOL FOR
STANDARD HYDRAULICALLY
DRIVEN PUMPS**



ORDER DATA:

Order no.:	617601 # 132	Shipyard:	CSBC Corp, Taiwan
No of pumps:	10	Yard no.:	1054
Pump code:	SD200-6 DTHH200-C347	Class:	BV
Pump spec.:	0115-1742-401	Stamped:	BV 114701-114710 16
Material casing:	EN1.4432		
Material shaft:	EN1.6582		
Material impeller:	CF3M+Mo		

SPECIFIED TEST DATA:

Capacity:	537 m ³ /h	Oil consumption:	510 l/min.
Head:	100 mwc	Hydr. pressure:	255 bar
Power:	193,0 kW	Speed:	2461 rpm
Test medium:	Fresh water		

RECORDED DATA:

Pump no.	Capacity	Discharge head	Suction head	Oil consum.	Hydraulic pressure	Return pressure	Motor no.
	Q	Hd	Hs	q	Pp	Pr	
	TP1 m ³ /h	TP2 mlc	TP6 mlc	TP5 l/min	TP3 bar	TP4 bar	
Ry3 114701	537	100		503	261	5,0	3455 4878
Ry2 114702	537	100		504	260	5.0	3455 4881
Ry3 114703	537	100		505	260	5.0	3455 4877
Ry2 114704	537	100		503	258	5.0	3455 4879
Ry3 114705	537	100		502	259	5.0	3460 9859
Ry2 114706	537	100		500	258	5.0	3455 4882
Ry2 114707	537	100		504	258	5.0	3455 4880
Ry3 114708	537	100		503	260	5.0	3455 4883
Ry3 114709	537	100		502	258	5.0	3455 4874
114710	537	100		503	260	4.0	3455 4869
DV2 114710	0	152		570	157	5.0	

CLASS DATA:

Capacity	Discharge Head	Average Oil consume	Average Δ P	Average Power
m ³ /h	mlc	l/min	bar	kW
537	100	0	0	0,0

Witnessed by	Sign.	Date
Test Engineer	<i>N.H. Neel</i>	08.03.2016
Witnessed		
Witnessed		

These final test results are to be complied with the approved drawings issued by Framo.

3/8/2016
3/8/2016

**TEST PROTOCOL FOR
STANDARD HYDRAULICALLY
DRIVEN PUMPS**



ORDER DATA:

Order no.:	617601 # 133	Shipyard:	CSBC Corp, Taiwan
No of pumps:	2	Yard no.:	1054
Pump code:	SD200-6 DTHH200-C347	Class:	BV
Pump spec.:	0115-1742-407	Stamped:	BV 114711-114712 16
Material casing:	EN1.4432		
Material shaft:	EN1.6582		
Material impeller:	CF3M+Mo		

SPECIFIED TEST DATA:

Capacity:	537 m ³ /h	Oil consumption:	510 l/min.
Head:	100 mwc	Hydr. pressure:	255 bar
Power:	193,0 kW	Speed:	2461 rpm
Test medium:	Fresh water		

RECORDED DATA:

Ry3
RV2

Pump no.	Capacity	Discharge head	Suction head	Oil consum.	Hydraulic pressure	Return pressure	Motor no.
	Q	Hd	Hs	q	Pp	Pr	
	TP1 m ³ /h	TP2 mlc	TP6 mlc	TP5 l/min	TP3 bar	TP4 bar	
114711	537	100		504	259	4.0	34609857
114712	537	100		501	260	4.0	34609855
114712	0	153		570	156	5.0	

CLASS DATA:

Capacity	Discharge Head	Average Oil consume	Average Δ P	Average Power
m ³ /h	mlc	l/min	bar	kW
537	100	0	0	0,0

Witnessed by	Sign.	Date
Test Engineer	Suje Solberg	8/3-16
Witnessed		
Witnessed		

These final test results are to be complied with the approved drawings issued by Framo.

程+齊 3/8/2016
董成辰 3/8/2016