FLENDER
GRAFFENSTADEN

FLENDER-GRAFFENSTADEN S.A., FRANCE
BP 84, F-67402 ILLKIRCH-CEDEX
1, rue du Vieux Moulin
F-67400 ILLKIRCH-GRAFFENSTADEN

Quotation

To

Company :	**Siemens AG**	**Name :**	**N. HOST**
City / Country :	**Duisburg / Germany**	**Dept :**	**Sales Dept.**
Name :	**Stoverink Simon**	**Tel :**	**+33 (0)3 69 20 51 50**
Dept :		**Fax :**	**+33 (0)3 88 67 60 75**
Tel :		**E-mail :**	**nhost@flender-graff.com**
Fax :		**Page(s) :**	**19**
E-mail :		**Copy :**	
		Date :	**16.03.2015**

Y/ref : **Khursaniyah Al Fadhili - D43-K-1801 -**
O/ref **: D41104 quotation number 3**

In response to your inquiry referenced above, we are pleased to confirm our quotation as follows :

ITEM A 1 : **Flender Graffenstaden** (FG) High Speed increaser, model ***TX50/4C***

- Rating conditions : Rated power at ***6800 kW***
Driven by a electric motor at ***1800.0 rpm*** (specified : 1800.0 rpm)
Driving a centrifugal compressor at ***7309.1 rpm*** (specified : 7285.0 rpm)
Service factor ***1.45*** according to ***API613/03*** (required : > 1.4)

- Technical description : Double helical
Manufacturing according to API standard
Flange on LS shaft end
Flange on HS shaft end
Estimated Weight : 4000 *kg*

- Bearings description : 2 cylindrical bearings on LS shaft
2 offset bearings on HS shaft
1 double acting tilting pad thrust bearing on low speed shaft non driven end

- Mechanical running test : Full speed, no load test during 4 hours according to the API 613 5th Edition standard.

- Lubrication conditions : 164 l/min of Oil ISO VG 46 at 60°C and 2.5 bar at inlet (calculated values only)

- Miscellaneous: Efficiency at full load : 99.03 %
Power losses at full load : 66 kW (calculated value only)
Anticipated Sound Pressure Level: 82.0 ± 2dB(A) at 1 meter

Base price : ***117 900 EUR*** each gear box
Delivery time : ***36 weeks*** after the FG acknowledgement of the order
Quantity : ***8 gearboxes***

FLENDER-GRAFFENSTADEN S.A., FRANCE
BP 84, F-67402 ILLKIRCH-CEDEX
1, rue du Vieux Moulin
F-67400 ILLKIRCH-GRAFFENSTADEN

Comments :

- Coupling data taken into account on HS Shaft:
  - Weight: 26.6 kg
  - Center of gravity position from shaft end: 30.9 mm
  - Inertia: 0.266 kgm^2
- Coupling data taken into account on LS Shaft:
  - Weight: 87.5 kg
  - Center of gravity position from shaft end: 40.9 mm
  - Inertia: 0.875 kgm^2

Including :

- Customer witness of test
- After test disassembly and inspection
- Noise level test report
- Lateral analysis undamped
- Documentation : downloadable electronic file in english

Instrumentation *(see the complete package on additional technical data sheet):*

- *Temperature package*
  12 RTD's PT100 Duplex 3 wires from Thermo Electric Company Inc.
  (2 per bearing and thrust bearing side) not wired with terminal heads.....Price included
- *Bently Nevada vibration package*
  8 radial (4 per shaft) & 2 axial (on LS shaft) vibration probes, 2 accelerometers (1 per shaft), 2 keyphasors (1 per shaft) not wired .....Price included

Spare parts *(Prices are net valid only if spares are ordered together with the gearbox):*

- *Commissioning Spares*
  2 RTD's, 2 BN vibration probes, 2 BN accelerometers .....7 900 EUR Lot Net
- *2 Years Normal Operation Spares*
  2 set of bearings with RTD's, 1 set of oil seals .....48 420 EUR Lot Net
- *Strategic Spare Parts*
  One complete set of rotating elements consisting of one pinion and one gear.
  Tested if ordered together with the main gearbox according to API613/03
  Full Speed, No Load, with Test Report.....51 500 EUR Lot Net
- *Container for horizontal spare rotors storage* painted according FG standard.....17 100 EUR Lot Net

FLENDER
GRAFFENSTADEN

SPECIAL PURPOSE GEAR UNITS
API 613 FIFTH EDITION
DATA SHEET SI UNITS

Job No. 41104 Item No. A
P.O. No. Date
Requisition No.
Inquiry No.
Revision 1 Date 06.03.2015 By HNI

Applicable To: ◉ Proposal ○ Purchase ○ As Built ○ US Standards (1.7) ◉ ISO Standards (1.7)

For	Siemens AG Duisburg	Manufacturer	FLENDER-GRAFFENSTADEN
Site	Khursaniyah Al Fadhili	Model No.	TX50/4C
Unit	STC-SV 08-4-A	Serial No.	
Service	EM/CC	Driver type	electric motor
No. required	9	Driven equipment	centrifugal compressor

NOTE : Numbers within ( ) refer to applicable API standard 613 paragraphs

○ Information To be completed by purchaser **□ Information to be completed by manufacturer**

○ UNITS OF MEASUREMENT

○ US Customary units
◉ SI units

○ RATING REQUIREMENTS

Driven equip. (2.1.4): Norm. ____ Max ____ kW
Driver: Rated ____ Max ____ kW
Normal transmitted power (2.2.2) ____ kW
Gear unit rated power (2.2.1) 6800 kW
Torque @ max cont speed ____ Nm
Max torque (2.2.1) ____ Nm @ ____ rpm
○ Reducer ◉ Increaser
Rated speed (2.1.5):
Input 1800 rpm ○ Specified ◉ Nominal
Output 7285 rpm ○ Specified ◉ Nominal
Allow var in gear ratio (2.1.5) (+) (-) ____ %
Max continuous speed (1.5) 1800 / 7285 rpm
Trip speed (1.5) (2.1.7) 1980 / 8013,5 rpm
Gear service factor (2.2.3.1) 1,4 API 613/2003 5 TH (min)
Hardness (2.2.3.2) Pinion ____ Gear ____
Shaft assembly designation (2.1.19) L/R
HS shaft rot fac'g cpl'g (2.1.20.2) ☑ CW ☐ CCW
LS shaft rot fac'g cpl'g (2.1.20.2) ☑ CW ☐ CCW
External loads (2.1.16) ____
Other operating conditions (2.2.2) (2.6.1.3) ____

○ INSTALLATION DATA (2.1.14)

☐ Indoor ☐ Heated ☐ Under roof
☑ Outdoor ☐ Unheated ☐ Partial sides
☐ Grade ☐ Mezzanine ☑ ONSHORE
☐ Winterization required ☐ Tropicalization required
Electrical area (2.1.10) Class ____ Grp ____ Div ____
Electrical area (2.1.10) Zone 2 Grp IIA Temp T1 °C
Max allow SPL (2.1.6) ____ dB(A) @ ____ m
Elevation ____ m Barometer ____ kPa abs
Range of ambient temperatures:

	Dry bulb		Wet bulb	
Normal		°C		°C
Maximum	82	°C		°C
Minimum	0	°C		°C

Unusual conditions ☐ Dust ☐ Fumes
☐ ____

■ BASIC GEAR DATA

◉ Single stage ○ Single helical
○ Double stage ◉ Double helical
○ Epicyclic ○ horizontal offset

Mechanical rating (1.5.16) 9520 kW @ 1800 / 7309,1 rpm
Gear service factor (2.2.3.1) 1,44 API 613/2003 5 TH (actual)
Full load gear unit power loss 66 kW
Gear Unit Mechanical efficiency 99,03 %
Rating speed Pinion 7.309,1 Gear 1.800,0 rpm
Hardness used for
Rating, (HB or Rc) Pinion 58 HRC Gear 58 HRC
Tooth pitting index, "K" (2.2.4.1) (2.2.4.2)
Allowable 2,17 Actual 2,10 MPa
Material index number (Fig 3, Table 4) 3,03 MPa
Bending stress number, "S_t" (2.2.5.1) (2.2.5.2)
Pinion: Allowable 265,4 Actual 256,0 MPa
Gear: Allowable 265,4 Actual 246,9 MPa
Pitch line velocity 77,1 m/s
Anticipated SPL (2.1.6) 82 dB(A) @ 1 m
WR^2 referred to LS shaft 126,12 kgm²
Breakaway torque 412 Nm @ LS Shaft
Pinon teeth hardness range 58 - 63 HRC
Pinion teeth hardening method CARBURIZED
☐ HS shaft separate hardness range ____
Gear teeth (rim) hardness range 58 - 63 HRC
Gear teeth hardening method CARBURIZED
Gear hub:
☑ Forged cylinder ☐ Forged & Copped ☐ Fabricated
Gear to Shaft fit method (2.5.3.2)
☐ Integral ☐ Keyed interference ☑ Keyless interference
Rim attachment (2.5.3.2) FORGED GEAR WHEEL
LS shaft hardness range HB 230 - 274
Journal static weight loads (2.6.6.3)
Pinion 128 / 42 kg Gear 942 / 707 kg
Total gear unit assembled weight 4000 kg
NOTES: ____

1/1

FLENDER
GRAFFENSTADEN

SPECIAL PURPOSE GEAR UNITS
API 613 FIFTH EDITION
DATA SHEET SI UNITS

Job No. 41104 Item No. A
P.O. No. Date
Requisition No.
Inquiry No.
Revision 1 Date 06.03.2015 By HNI

■ GEAR DATA

	Pinion	Gear	
Number of teeth	33	134	
Gear ratio	4,06		
Tangential load, "Wt" (2,2,4,2)	88.155		N
AGMA Geometry factor "J"	0,55	0,57	
Pitch diameter	201,56	818,44	mm
Outside diameter	214,10	827,60	mm
Root diameter	187,25	800,74	mm
Center groove diameter	177,00	790,00	mm
Normal pressure angle	20,00		deg
Normal diametral pitch	4,62		in^{-1}
Helix angle	25,00		deg
Center distance	510,00		mm
Backlash min	0,34		mm
Net face width, "Fw"	260,00		mm
Pinion L/D	1,71		
Face overlap ratio	6,36		
Transverse contact ratio	1,45		
AGMA 6011 service factor	2,64		
Rating based on ANSI/AGMA 6011 with SF=1.0			
Durability Power	21442		kW
Strength Power	17946		kW
Tooth Surface Finish, Ra	0,4	0,4	µm
Tooth Generation Process	Hobbing	Hobbing	
Tooth Finishing Process	Grinding	Grinding	
Lead modification (2.2.4.6)	◉ Not Req'd	○ Req'd	
Calculated Total Lead Mismatch			µm

■ SCUFFING DATA (2.2.6)

Scuffing Data per ANSI/AGMA 925-A03

Scuffing Risk (2.2.6)	<=5% (Low)	Calculation Method	AGMA925
Composite surface roughnexss, σx	0,57		µm
Specific film thickness, EHL λmin	3,31		µm
Tooth temperature, θm	82		°C
Maximum contact temperature, θBmax	101		°C

■ MATERIALS

Gear casing	Steel	Oil seals	aluminium
Pinion(s)	18CrNiMo7-6		
Gear rim(s)	18CrNiMo7-6		
HS Shaft	Integral	LS Shaft	42CrMo4
Radial bearings	Babbit	Backing	Steel
Thrust bearing(s)	Babbit	Backing	Steel

○ SHAFT END DETAIL

☑ Gear shaft end for coupling integral flange (2.5.4.2)
☑ Pinion shaft end for coupling integral flange (2.5.4.2)
☑ Other : WITHOUT BOLTS

○ COUPLINGS AND GUARDS

	Pinion	Gear
Coupling furnished by (3.2.1)	Compr. Supplier	Compr. Supplier
Mount coupling halves (3.2.2)	Compr. Supplier	Compr. Supplier
Cplg. guard adapter by (3.2.3)	Gear Supplier	Gear Supplier
Cplg. guard furnished by (3.2.3)	Compr. Supplier	Compr. Supplier
Coupling vendor (3.2.3)		
Vendor's model number (3.2.3)		
Coupling weight on shaft, kg	26,6	87,5
CG inboard / outboard of shaft end	Outboard	Outboard
Hub drill template provided	☐	☐

■ SHAFT END DETAIL (2.5.4.2)

Shaft end detail specified by: ◉ Purchaser ☐ Gear vendor
(Integral unless otherwise specified)

Shaft end detail if 'otherwise' specified:	Pinion	Gear
Tapered / Keyless	○ ☐	○ ☐
Tapered / 1-Key	○ ☐	○ ☐
Tapered / 2-Keys	○ ☐	○ ☐
Cylindrical / 1-Key	○ ☐	○ ☐
Cylindrical / 2-Keys	○ ☐	○ ☐
Other Flanged	◉ ☐	◉ ☐
Shaft diameter	120,0	190,0 mm

(If integral flange use diameter imediately adjacent to flange)

■ RADIAL BEARINGS

	Pinion	Gear	
Type	OFFSET / OFFSET	CYL. / CYL.	
Diameter	130 / 130	200 / 200	mm
Length	130 / 130	100 / 100	mm
Journal velocity	49,8 / 49,8	18,8 / 18,8	m/s
Loading	2,78 / 2,81	2,87 / 2,71	N/mm²
Clearance (min-max)			mm
Span	550	550	mm
Power loss each bearing	13,8 / 13,8	3,0 / 3,0	kW
Oil flow each bearing	42,0 / 42,0	10,0 / 10,0	l/min

■ THRUST BEARINGS

Location		OPP.CPLG.SIDE	
Manufacturer	FLENDER	FLENDER	
Type	NO	COMB.TAP.LANDS	
Size		BPK LEG 6"	
Area		11615	mm²
Loading		1,14	MPa
Rating		1,50	MPa
Int. thrust load			N
Ext. thrust load	4.050	9.200	N
Power loss each	0,0	6,0	kW
Oil flow each bearing	0,0	20,0	l/min

NOTES :

1/1

FLENDER
GRAFFENSTADEN

SPECIAL PURPOSE GEAR UNITS
API 613 FIFTH EDITION
DATA SHEET SI UNITS

Job No. 41104 Item No. A
P.O. No. Date
Requisition No.
Inquiry No.
Revision 1 Date 06.03.2015 By HNI

O LUBRICATION REQUIREMENTS

☐ Oil system furnished by (2.8.3)
☐ Other ☐ Gear vendor
☐ Oil visc. cp @ 40°C cp @ 100°C (2.8.6)
☐ ISO Grade Load stage (2.2.6) 5,0

■ MESH

Mesh and windage power loss	26,4	kW
Oil flow, mesh	40,0	l/min

■ LUBRICATION REQUIREMENTS

Min. startup oil temperature	20,0	°C
Normal oil inlet temperature	60,0	°C
Maximum oil inlet temperature	65,0	°C
Unit oil flow (total)	164,0	l/min
Unit oil pressure	2,5	bar

☐ Oil visc. cp @ 40°C cp @ 100°C (2.8.6)
☐ ISO Grade 46 Load stage (2.2.6) 5,0

■ PIPING CONNECTIONS

Service	No.	Size	Type
Lube oil inlet	1	2 in.	ANSI 150 LBS
Lube oil outlet	1	6 in.	ANSI 150 LBS
Casing drain *			
Vent	1	1,5 in.	ANSI 150 LBS
Casing purge			

* Casing drain is 'dead bottom' housing drain, not lube oil outlet

O MOUNTING PLATES

☐ Gear furnished with (3.3.1.1)
☐ Baseplate ☐ Soleplate ☐ Subplate(s) (3.3.2.10)
☐ Mounting plates(s) furnished by (3.3.1.1)
☐ Baseplate leveling (3.3.2.3)
☐ Baseplate with leveling pads (3.3.2.3)
☐ Baseplate suitable for column mounting (3.3.2.4)
☐ Vendor review of purchaser's foundation dwgs. (2.1.13)
☐ Grout type (3.3.1.2.4)

O CONTRACT DATA

☐ Test data prior to shipment
☑ Progress report (5.3.3)
☐ Vendor signoff of inspector checklist (4.1.1.3)
☑ Information retained for 20 years (4.2.1.1) (4.2.2.6.1)
☐ Technical manual (5.3.5.4)
☑ PAINTING (4.4.3.1) ☑ Flender standard RAL5015 (blue)
☑ Painting housing interior not allowed (2.3.1.14)

O SHIPMENT

☐ Steel rotor storage container (4.4.5) ☐ Shaft covers (4.4.4)

	Contract unit	Spares
Export boxing	☐	☐
Domestic boxing	☐	☐
Outdoor storage over 6 mos.	☐	3 years indoor ☐ (4.4.3.8)

O ADDITIONAL REQUIREMENTS

O VIBRATION DETECTORS

RADIAL (3.4.2.1) (2.7.4.5) (2.7.4.6)
☑ Manufacturer BENTLY NEVADA ☑ Total No. 8
☑ X-Y probes pinion bearings ☑ Coupling end ☑ Blind end
☑ X-Y probes gear bearings ☑ Coupling end ☑ Blind end
☐ Other

AXIAL (3.4.2.1) (2.7.4.5) (2.7.4.6)
☑ Manufacturer BENTLY NEVADA ☑ Total No. 2
☐ Dual probes at each thrust bearing
☐ Single probe any shaft without thrust bearing
☐ Other

ONE EVENT PER REVOLUTION PROBE (2.7.4.5) (2.7.4.6)
☑ Manufacturer BENTLY NEVADA Total No. 2
☑ One on input shaft ☑ One on output shaft
☐ Other

ACCELEROMETER (3.4.2.1) (2.7.4.5) (2.7.4.6)
☑ Manufacturer BENTLY NEVADA ☑ No. required 2
☑ Pinion coupling end ☑ Gear coupling end
☐ Other

O TEMPERATURE DETECTORS

☐ Dial type thermometers (3.4.2.7)
☑ Type brg. temp. sensors (3.4.2.7) (2.7.1.3) PT100
☐ RTD ☐ Thermocouple / ☐ Simplex ☑ Duplex
Calibration Yes
☑ HS/LS bearings no. sensors each 2 / 2
☑ Thrust number of sensing elements each face 2

O OTHER VIBRATION AND TEMPERATURE

(3.4.2.5) (3.4.2.6)	Other	Gear vendor
Oscillator demodulator supplied by	☐	☑
Vibration monitor supplied by	☑	☐
☐ Vibration shutdown delay time		seconds
Temperature monitor supplied by	☑	☐
Oscillator demodulator J-box by	☑	☐
Temp. sensor termination J-box by	☑	☐

J-box type Mount

O MISCELLANEOUS

☑ Undamped critical analysis report (2.6.2.1)
☐ w/ dampd rotr respns analys rprt (2.6.2.4.3) (2.6.2.6)
Torsional analysis by (2.6.5.2) ☐ Gear vendor ☑ Other
☐ Spare set of gear rotors (4.3.2.4)
☐ Gear case furnished with inlet purge connection (2.4.3)
☐ Orientation of oil inlet & drain conns. (2.4.6)
☑ Filter breather location (2.3.1.12) Prov. on upper casing
☐ Torsional device provisions (2.5.4.5)
☐ Rotor vertical storage provisions (2.5.4.8)
☐ Rotor vertical storage fixture(s) (3.6.2)
☐ Vendor service rep. on site (2.1.13)

1/1

FLENDER
GRAFFENSTADEN

SPECIAL PURPOSE GEAR UNITS
API 613 FIFTH EDITION
DATA SHEET SI UNITS

Job No. 41104 Item No. A
P.O. No. Date
Requisition No.
Inquiry No.
Revision 1 Date 06.03.2015 By HNI

O INSPECTIONS AND TESTS (4.1)

☐ Advance notice of witness testing required (4.1.3)
Number calendar days

	Req'd	Witness	Observe	Test Log
Shop Inspection (4.1.1)	☐	☐	☐	
Cleanliness Inspection (4.2.3.1)	☐	☐	☐	
Hardness Verification (4.2.3.3)	☑	☐	☐	☑
Dismantle-reassembly (4.3.2.3.1)	☑	☐	☐	☐
Contact Check (2.5.2.2)	☑	☐	☐	☐
Contact Check Tape Lift (2.5.2.2)	☑	☐	☐	☑
Gear accuracy check (2.5.2.1)	☑	☐	☐	☐
Double helical axial stability (2.5.2.3)	☑	☐	☐	☑
Special testing Integral forged gears (2.5.3.3) (testing per mutual agreement)	☐	☐	☐	☐
Residual unbalance check (2.6.6.2)	☑	☐	☐	☑
Mechanical Run Test (Main) (4.3.2)	☑	☐	☐	☑
Mechanical Run Test (Spare) (4.3.2.4)	☐	☐	☐	☐
Addl. Mechanical Tests (4.3.2.2.16)	☐	☐	☐	☐
Part or Full Load And Full Speed Test (4.3.3.1)	☐	☐	☐	☐
Full torque, reduced speed (4.3.3.2)	☐	☐	☐	☐
Full Torque Static Test (4.3.3.3)	☐	☐	☐	☐
Back-To-Back Locked Torque Test (4.3.3.4)	☐	☐	☐	☐
Sound Level Test (4.3.3.5)	☑	☐	☐	☑
Additional gear tooth test (4.2.2.8)	☐	☐	☐	☐
Use shop Lube System	☑	☐	☐	
Use Job lube system	☐	☐	☐	
Use shop Vibration Probes, Etc.	☐	☐	☐	
Use Job Vibration Probes, Etc.	☑	☐	☐	
Final Assembly, Maintenance & Running Clearance (4.2.1.1.e)	☑	☐	☐	☑
Oil System Cleanliness (4.2.3.2)	☐	☐	☐	
Oil System-Casing Joint Tightness (4.3.2.1.4)	☐	☐	☐	
Warning And Protection Devices (4.3.2.1.5)	☐	☐	☐	
Seismic Vibration Data (4.3.2.2.3)	☐	☐	☐	☐
Vibration, Phase Plots (4.3.2.2.12)	☑	☐	☐	☑
Oil inlet Range test (4.3.2.2.13)	☐	☐	☐	☐
Tape recorded Vibration Data (4.3.2.2.14) (4.3.2.2.15)	☑	☐	☐	☑
	☐ Purchaser copy			

NON-DESTRUCTIVE TESTING (4.2.1.2) (4.2.2.1)

	Surface	Sub surface		Log
☐ Casing	☐	☐		☐
☑ Rot. Elemts.	☑	☑		☑
☑ Bearings	☑	☑		☑
☐ Other :	☐	☐		☐

(Specify)

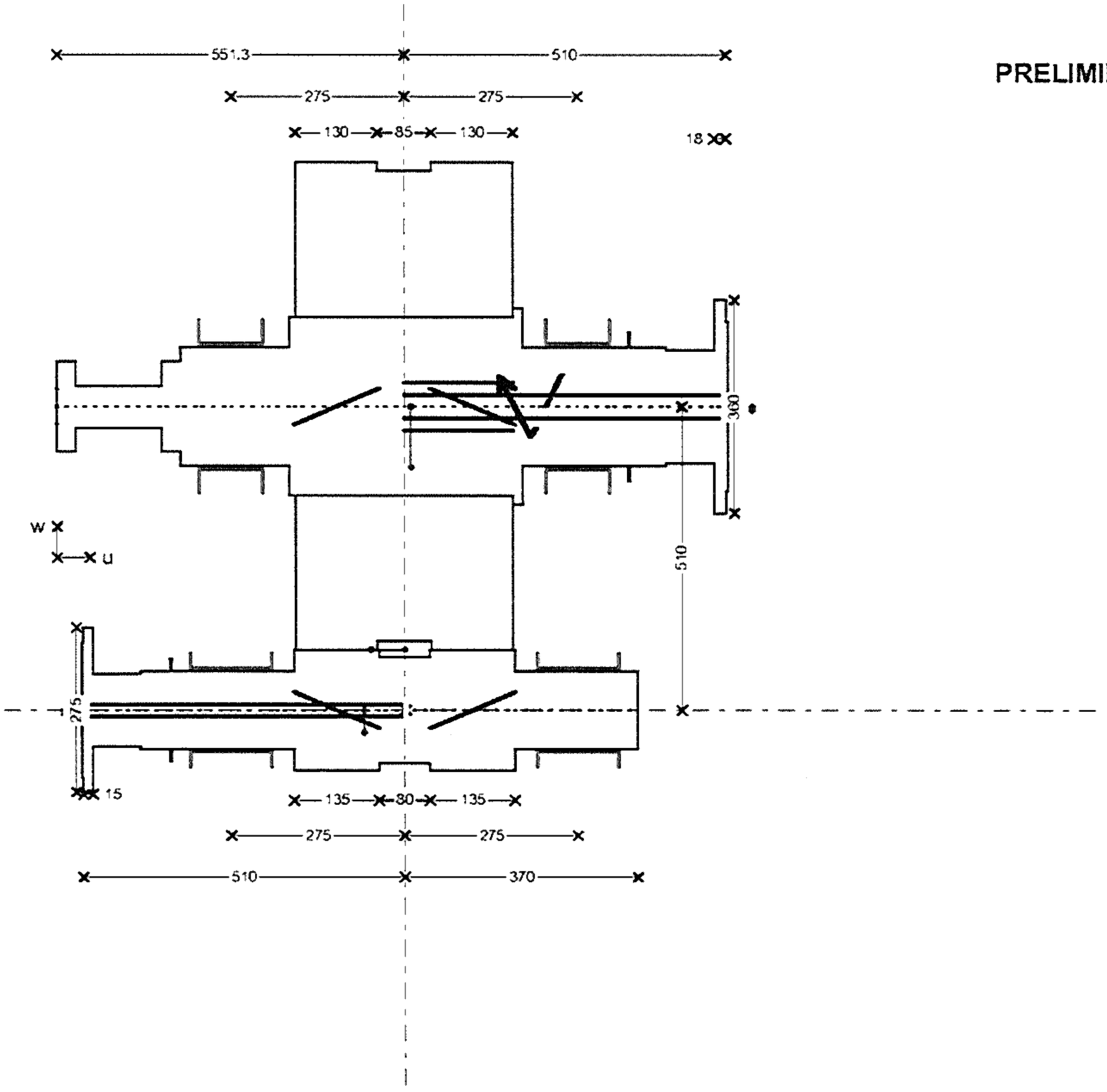
NOTES :

During start-up, gears can exhibit a transient spike reading of vibration levels that will exceed shutdown settings. Therefore a trip multiplier is recommended in the control system.

Mechanical running test duration 4 hours including
- Shaft vibration record using job vibration probes if ordered
- Bearings temperature records
- Casing vibration measurement
- Sound level pressure measurement
- Power losses measurement at oil outlet
- Performed with oil ISO VG 32

Oil flow requirement and power losses are calculated values only, add normal safety margins for sizing heat exchangers.

1/1



FLENDER
GRAFFENSTADEN

PRELIMINARY MASS ELASTIC DATA

Customer : Siemens AG Duisburg
Destination : Khursaniyah Al Fadhili
Purchaser order :
F-G job number : D 41104A1 OL:
Type and serial N° : TX50/4C

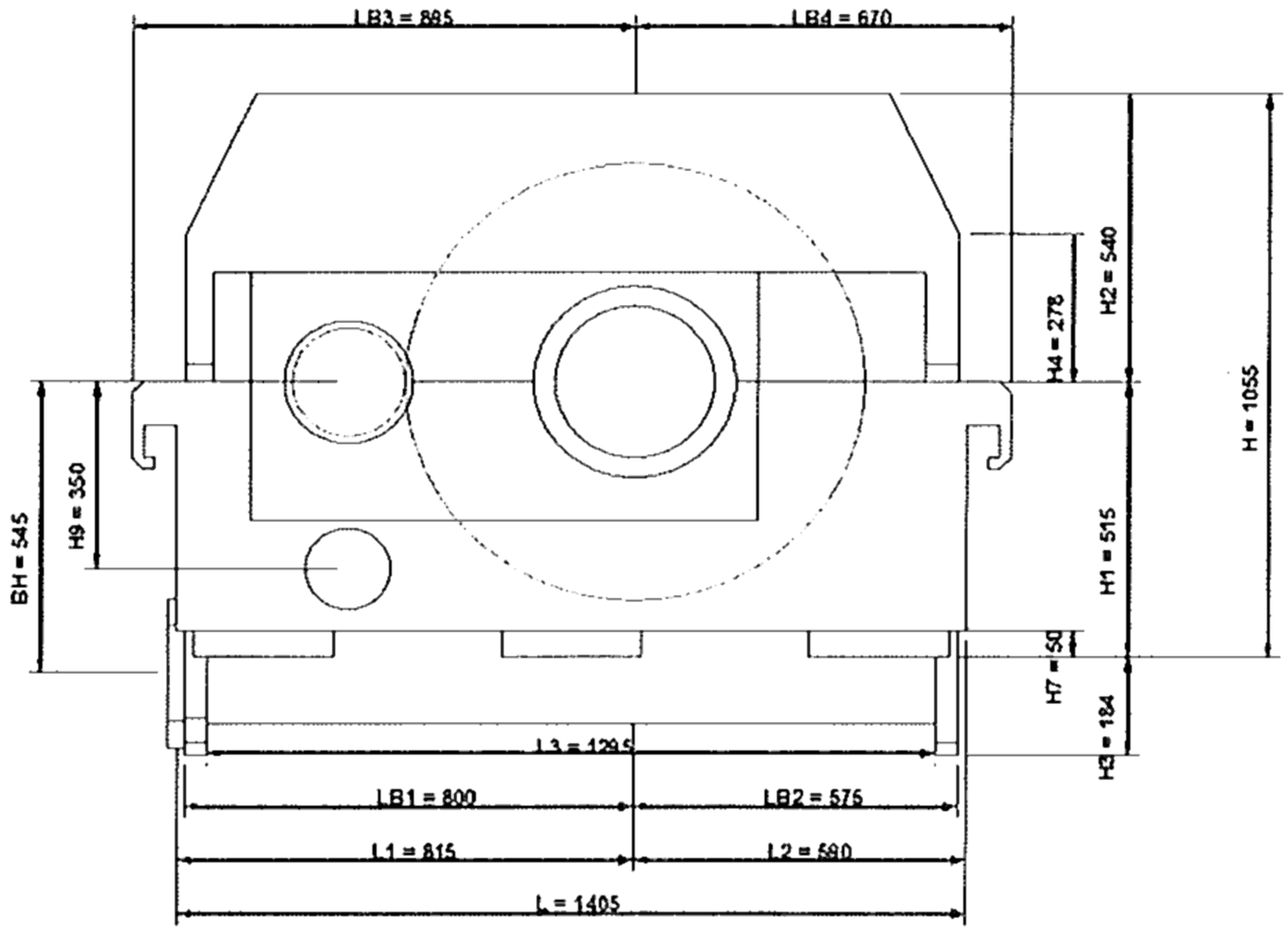
Power rating : 6800 kW
Service factor : API613/03 >=1,4
Input speed : 1800 rpm
Output speed : 7309,1 rpm
Speed ratio : 4,06

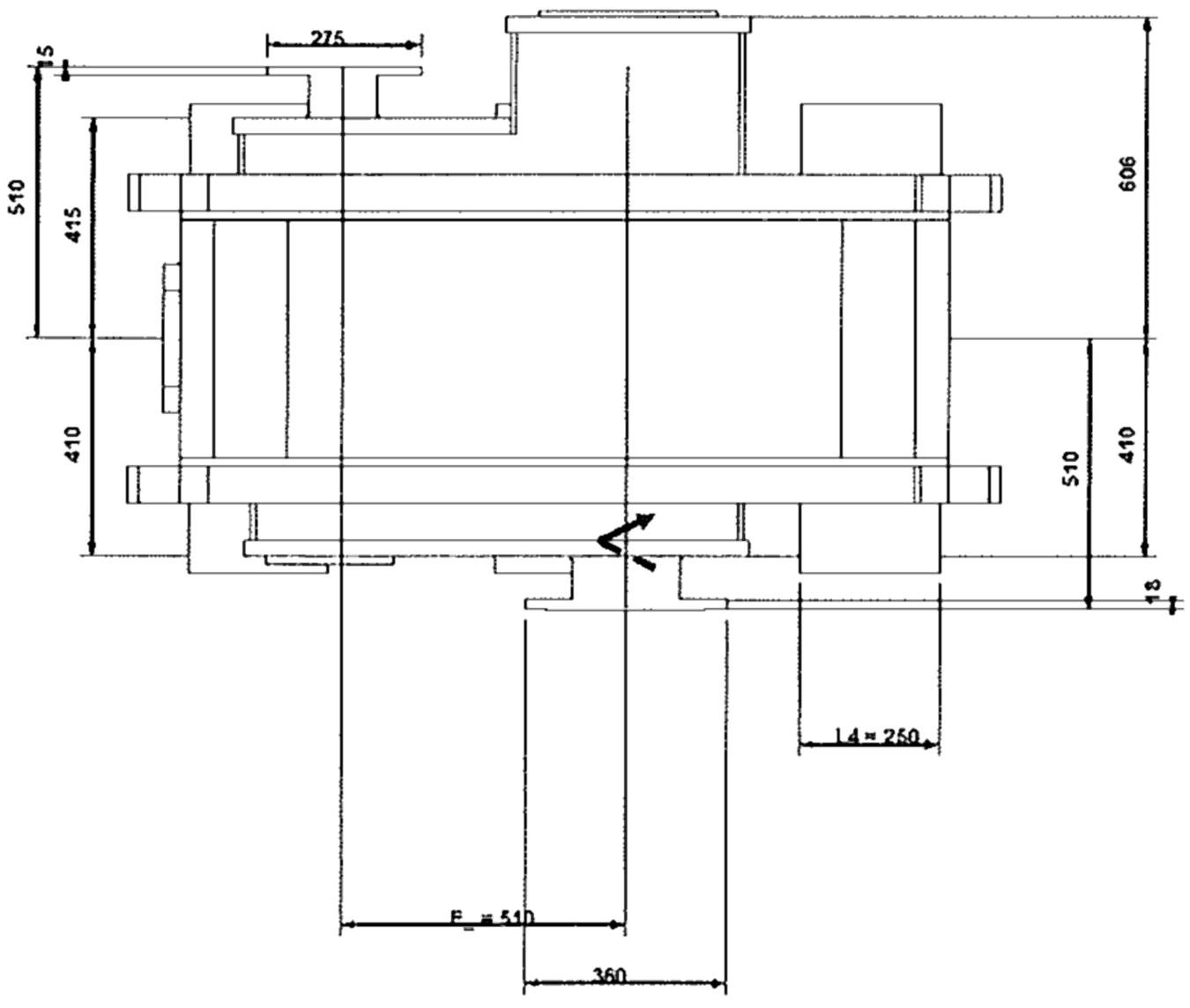
Weight HSS : 143,5 kg
Weight pos. from teeth middle HSS : -63,4 mm
Inertia HSS : 0,585 Kg.m²
Stiffness HSS : 5,916 MNm/rd
Bearing type 1 : Offset 130 x 130
Bearing type 2 : Offset 130 x 130
Add. weight on brg. side 1 : 26,6 kg

Weight LSS : 1561,2 kg
Weight pos. from teeth middle LSS : 10,5 mm
Inertia LSS : 116,473 Kg.m²
Stiffness LSS : 39,014 MNm/rd
Bearing type 4 : Cylindrical 200 x 100
Bearing type 3 : Cylindrical 200 x 100
Add. weight on brg. side 4 : 87,5 kg

Positive direction of external

APPAREIL.xls _ Edition du :06.03.2015
1/1


LB3 = 885
LB4 = 670
H4 = 278
H2 = 540
H = 1055
BH = 545
H9 = 350
H1 = 515
H7 = 50
H3 = 184
L3 = 1295
LB1 = 800
LB2 = 575
L1 = 815
L2 = 590
L = 1405


275
15
510
415
410
606
510
410
18
L4 = 250
L5 = 510
360

ADDITIONAL TECHNICAL DATASHEET

Job No. 41104 Item No. A
P.O. No. Date
Requisition No.
Inquiry No.
Revision 1 Date 06.03.2015 By HNI

☑ ADDITIONAL GEAR DATA

Efficiency

Percent of rated power	Efficiency
100%	99,03
75%	98,92
50%	98,79
25%	98,08
10%	90,80

Losses

Power loss at no load kW
Heat rejection kcal/h

☐ PUMP DETAILS (Dimensioning is preliminary !)

Design :
Speed : rpm
Oil flow : l/min
Oil pressure : bar
NPSH : m
Safety valve :
Driving method :
Material :
Flanges :
Testing :
Furniture of ATEX certificate :

☐ TURNING GEAR (Dimensioning is preliminary !)

Calculation results

Required turning speed rpm
Actual turning speed rpm
Required breakaway torque Nm
Actual breakaway torque Nm
Actual maximun torque Nm
Actual acceleration time s

Motor

Supplier
Power kW
Voltage V
Frequency Hz
Speed rpm
Electric standard

Turning gear

Type
Ratio

Clutch

Type
Max. allowable torque Nm

Miscellaneous

Starting device
Switch details

☑ INSTRUMENTATION PACKAGE

Thermometer

	Bearing	Thrust bearing	Oil inlet/outlet
Qty			
Type			

Thermoelements

	Bearing	Thrust bearing	Oil inlet/outlet
Type	DUPLEX 2x3F	DUPLEX 2x3F	
Classification	IEC60751	IEC60751	
Removable from the outside	NO	NO	
ATEX	ATEX Eexia	ATEX Eexia	

Shaft vibrations

	Radial	Axial		Keyphasor	Accelerometer
Type	B.N. 3300 XL 8mm Sys. 9M	HS	No	B.N. 3300 XL 8mm Sys. 9M	ACCELEROMETER BENTLY
		LS	BENTLY NEVADA 3300 XL 8mm Sys. 9M		
Probe	Yes	HS	No	Yes	
		LS	Yes		
Proximitor	Yes	HS	No	Yes	
		LS	Yes		
Probe holder	Yes	HS	No	Yes	
		LS	Yes		
Connection head	Yes	HS	No	Yes	
		LS	Yes		
mounting kit					Yes

Junction box(es)

Qty 0
Manufacturer
Material
ATEX None

Miscellaneous

Identification ☑ wire ☑ conduit ☐ junction box
Conduit type
Transmitter type Qty
Terminal block type Qty

FLENDER
GRAFFENSTADEN

FLENDER-GRAFFENSTADEN S.A., FRANCE
BP 84, F-67402 ILLKIRCH-CEDEX
1, rue du Vieux Moulin
F-67400 ILLKIRCH-GRAFFENSTADEN

Y/ref : **Khursaniyah Al Fadhili - D43-K-3801 -**
O/ref **: D41104 quotation number 3**

ITEM B 1 : **Flender Graffenstaden** (FG) High Speed increaser, model ***TX40/5C***

- *Rating conditions :* Rated power at ***1620 kW***
  Driven by a electric motor at ***1800.0 rpm*** (specified : 1800.0 rpm)
  Driving a centrifugal compressor at ***10737.9 rpm*** (specified : 10736.0 rpm)
  Service factor ***1.47*** according to ***API613/03*** (required : > 1.4)

- *Technical description :* Double helical
  Manufacturing according to API standard
  Flange on LS shaft end
  Flange on HS shaft end
  Estimated Weight : 1900 *kg*

- *Bearings description :* 2 cylindrical bearings on LS shaft
  2 tilting pads bearings on HS shaft
  1 double acting tilting pad thrust bearing on low speed shaft non driven end

- *Mechanical running test :* Full speed, no load test during 4 hours according to the API 613 5th Edition standard.

- *Lubrication conditions :* 64 l/min of Oil ISO VG 46 at 60°C and 2.5 bar at inlet (calculated values only)

- *Miscellaneous:* Efficiency at full load : 98.70 %
  Power losses at full load : 21 kW (calculated value only)
  Anticipated Sound Pressure Level: 82.0 ± 2dB(A) at 1 meter

Base price : ***103 850 EUR*** each gear box
Delivery time : ***36 weeks*** after the FG acknowledgement of the order
Quantity : ***1 gearbox***

FLENDER-GRAFFENSTADEN S.A., FRANCE
BP 84, F-67402 ILLKIRCH-CEDEX
1, rue du Vieux Moulin
F-67400 ILLKIRCH-GRAFFENSTADEN

Comments :

- Coupling data taken into account on HS Shaft:
  - Weight: 10.4 kg
  - Center of gravity position from shaft end: 28.2 mm
  - Inertia: 0.104 kgm^2
- Coupling data taken into account on LS Shaft:
  - Weight: 26.4 kg
  - Center of gravity position from shaft end: 30.9 mm
  - Inertia: 0.264 kgm^2

Including :

- Customer witness of test
- After test disassembly and inspection
- Noise level test report
- Lateral analysis undamped
- Documentation : downloadable electronic file in English

Instrumentation *(see the complete package on additional technical data sheet):*

- *Temperature package*
  12 RTD's PT100 Duplex 3 wires from Thermo Electric Company Inc.
  (2 per bearing and thrust bearing side) not wired with terminal heads.....Price included

- *Bently Nevada vibration package*
  8 radial (4 per shaft) & 2 axial (on LS shaft) vibration probes, 2 accelerometers (1 per shaft), 2 keyphasors (1 per shaft) not wired .....Price included

Spare parts *(Prices are net valid only if spares are ordered together with the gearbox):*

- *Commissioning Spares*
  2 RTD's, 2 BN vibration probes, 2 BN accelerometers .....7 900 EUR Lot Net

- *2 Years Normal Operation Spares*
  1 set of bearings with RTD's, 1 set of oil seals .....26 010 EUR Lot Net

- *Strategic Spare Parts*
  One complete set of rotating elements consisting of one pinion and one gear.
  Tested if ordered together with the main gearbox according to API613/03
  Full Speed, No Load, with Test Report.....37 100 EUR Lot Net

- *Container for horizontal spare rotors storage* painted according FG standard.....15 850 EUR Lot Net

FLENDER
GRAFFENSTADEN

SPECIAL PURPOSE GEAR UNITS
API 613 FIFTH EDITION
DATA SHEET SI UNITS

Job No. 41104 Item No. 8
P.O. No. Date
Requisition No.
Inquiry No.
Revision 1 Date 06.03.2015 By HNI

Applicable To: ◉ Proposal ○ Purchase ○ As Built ○ US Standards (1.7) ◉ ISO Standards (1.7)

For	Siemens AG Duisburg	Manufacturer	FLENDER-GRAFFENSTADEN
Site	Khursaniyah Al Fadhili	Model No.	TX40/5C
Unit	STC-SV 06-3-A	Serial No.	
Service	EM/CC	Driver type	electric motor
No. required	1	Driven equipment	centrifugal compressor

NOTE : Numbers within ( ) refer to applicable API standard 613 paragraphs

○ Information To be completed by purchaser ☐ Information to be completed by manufacturer

○ UNITS OF MEASUREMENT

○ US Customary units
◉ SI units

○ RATING REQUIREMENTS

Driven equip. (2.1.4): Norm. Max kW
Driver: Rated Max kW
Normal transmitted power (2.2.2) kW
Gear unit rated power (2.2.1) 1620 kW
Torque @ max cont speed Nm
Max torque (2.2.1) Nm @ rpm
○ Reducer ◉ Increaser
Rated speed (2.1.5):
Input 1800 rpm ○ Specified ◉ Nominal
Output 10736 rpm ○ Specified ◉ Nominal
Allow var in gear ratio (2.1.5) (+) (-) %
Max continuous speed (1.5) 1800 / 10736 rpm
Trip speed (1.5) (2.1.7) 1980 / 11809,6 rpm
Gear service factor (2.2.3.1) 1,4 API 613/2003 5 TH (min)
Hardness (2.2.3.2) Pinion Gear
Shaft assembly designation (2.1.19) L/R
HS shaft rot fac'g opt'g (2.1.20.2) ☑ CW ☐ CCW
LS shaft rot fac'g opt'g (2.1.20.2) ☑ CW ☐ CCW
External loads (2.1.16)
Other operating conditions (2.2.2) (2.6.1.3)

○ INSTALLATION DATA (2.1.14)

☐ Indoor ☐ Heated ☐ Under roof
☑ Outdoor ☐ Unheated ☐ Partial sides
☐ Grade ☐ Mezzanine ☑ ONSHORE
☐ Winterization required ☐ Tropicalization required
Electrical area (2.1.10) Class Grp Div
Electrical area (2.1.10) Zone 2 Grp IIA Temp T1 °C
Max allow SPL (2.1.6) dB(A) @ m
Elevation m Barometer kPa abs
Range of ambient temperatures:

	Dry bulb		Wet bulb	
Normal		°C		°C
Maximum	82	°C		°C
Minimum	0	°C		°C

Unusual conditions ☐ Dust ☐ Fumes
☐

■ BASIC GEAR DATA

◉ Single stage ○ Single helical
○ Double stage ◉ Double helical
○ Epicyclic ○ horizontal offset

Mechanical rating (1.5.16) 2268 kW @ 1800 / 10737,9 rpm
Gear service factor (2.2.3.1) 1,46 API 613/2003 5 TH (actual)
Full load gear unit power loss 21 kW
Gear Unit Mechanical efficiency 98,70 %
Rating speed Pinion 10.737,9 Gear 1.800,0 rpm
Hardness used for
Rating, (HB or Rc) Pinion 58 HRC Gear 58 HRC
Tooth pitting index, "K" (2.2.4.1) (2.2.4.2)
Allowable 2,17 Actual 2,06 MPa
Material index number (Fig 3, Table 4) 3,03 MPa
Bending stress number, "S_t" (2.2.5.1) (2.2.5.2)
Pinion: Allowable 265,4 Actual 251,0 MPa
Gear: Allowable 265,4 Actual 238,8 MPa
Pitch line velocity 63,0 m/s
Anticipated SPL (2.1.6) 82 dB(A) @ 1 m
WR^2 referred to LS shaft 29,88 kgm²
Breakaway torque 90 Nm @ LS Shaft
Pinon teeth hardness range 58 - 63 HRC
Pinion teeth hardening method CARBURIZED
☐ HS shaft separate hardness range
Gear teeth (rim) hardness range 58 - 63 HRC
Gear teeth hardening method CARBURIZED
Gear hub:
☑ Forged cylinder ☐ Forged & Copped ☐ Fabricated
Gear to Shaft fit method (2.5.3.2)
☐ Integral ☐ Keyed interference ☑ Keyless interference
Rim attachment (2.5.3.2) FORGED GEAR WHEEL
LS shaft hardness range HB 230 - 274
Journal static weight loads (2.6.6.3)
Pinion 37 / 4 kg Gear 347 / 253 kg
Total gear unit assembled weight 1900 kg
NOTES:

1/1

FLENDER
GRAFFENSTADEN

SPECIAL PURPOSE GEAR UNITS
API 613 FIFTH EDITION
DATA SHEET SI UNITS

Job No.	41104	Item No. 6
P.O. No.		Date
Requisition No.		
Inquiry No.		
Revision 1	Date 06.03.2015	By HNI

■ GEAR DATA

	Pinion	Gear	
Number of teeth	29	173	
Gear ratio	5,97		
Tangential load, "Wt" (2,2,4,2)	25.731		N
AGMA Geometry factor "J"	0,52	0,54	
Pitch diameter	111,98	668,02	mm
Outside diameter	120,30	673,50	mm
Root diameter	103,05	656,32	mm
Center groove diameter	93,00	640,00	mm
Normal pressure angle	20,00		deg
Normal diametral pitch	7,26		in^{-1}
Helix angle	24,25		deg
Center distance	390,00		mm
Backlash min	0,28		mm
Net face width, "Fw"	130,00		mm
Pinion L/D	1,74		
Face overlap ratio	4,86		
Transverse contact ratio	1,45		
AGMA 6011 service factor	2,87		
Rating based on ANSI/AGMA 6011 with SF=1.0			
Durability Power	5404		kW
Strength Power	4652		kW
Tooth Surface Finish, Ra	0,4	0,4	µm
Tooth Generation Process	Hobbing	Hobbing	
Tooth Finishing Process	Grinding	Grinding	

Lead modification (2.2.4.6) ◉ Not Req'd ○ Req'd

Calculated Total Lead Mismatch _____ µm

■ SCUFFING DATA (2.2.6)

Scuffing Data per ANSI/AGMA 925-A03

Scuffing Risk (2.2.6) <=5% (Low) Calculation Method AGMA925

Composite surface roughnaxss, σx	0,57	µm
Specific film thickness, EHL λmin	2,54	µm
Tooth temperature, θm	80	°C
Maximum contact temperature, θBmax	93	°C

■ MATERIALS

Gear casing	Steel	Oil seals	aluminium
Pinion(s)	18CrNiMo7-6		
Gear rim(s)	18CrNiMo7-6		
HS Shaft	Integral	LS Shaft	42CrMo4
Radial bearings	Babbit	Backing	Steel
Thrust bearing(s)	Babbit	Backing	Steel

○ SHAFT END DETAIL

☑ Gear shaft end for coupling integral flange (2.5.4.2)

☑ Pinion shaft end for coupling integral flange (2.5.4.2)

☑ Other : WITHOUT BOLTS

○ COUPLINGS AND GUARDS

	Pinion	Gear
Coupling furnished by (3.2.1)	Compr. Supplier	Compr. Supplier
Mount coupling halves (3.2.2)	Compr. Supplier	Compr. Supplier
Cplg. guard adapter by (3.2.3)	Gear Supplier	Gear Supplier
Cplg. guard furnished by (3.2.3)	Compr. Supplier	Compr. Supplier
Coupling vendor (3.2.3)		
Vendor's model number (3.2.3)		
Coupling weight on shaft, kg	10,4	26,4
CG inboard / outboard of shaft end	Outboard	Outboard
Hub drill template provided	☐	☐

■ SHAFT END DETAIL (2.5.4.2)

Shaft end detail specified by: ◉ Purchaser ☐ Gear vendor

(Integral unless otherwise specified)

Shaft end detail if 'otherwise' specified:	Pinion	Gear
Tapered / Keyless	○ ☐	○ ☐
Tapered / 1-Key	○ ☐	○ ☐
Tapered / 2-Keys	○ ☐	○ ☐
Cylindrical / 1-Key	○ ☐	○ ☐
Cylindrical / 2-Keys	○ ☐	○ ☐
Other Flanged	◉ ☐	◉ ☐

Shaft diameter 75,0 120,0 mm

(If integral flange use diameter imediately adjecent to flange)

■ RADIAL BEARINGS

	Pinion	Gear	
Type	T.PADS / T.PADS	CYL. / CYL.	
Diameter	80 / 80	120 / 120	mm
Length	56 / 56	60 / 60	mm
Journal velocity	45,0 / 45,0	11,3 / 11,3	m/s
Loading	3,08 / 3,10	2,52 / 2,26	N/mm²
Clearance (min-max)			mm
Span	340	340	mm
Power loss each bearing	6,3 / 6,3	0,7 / 0,7	kW
Oil flow each bearing	15,0 / 15,0	5,0 / 5,0	l/min

■ THRUST BEARINGS

Location		OPP.CPLG.SIDE	
Manufacturer	FLENDER	FLENDER	
Type	NO	COMB.TAP.LANDS	
Size		BPK LEG 4"	
Area		5160	mm²
Loading		1,35	MPa
Rating		1,50	MPa
Int. thrust load			N
Ext. thrust load	2.700	4.250	N
Power loss each	0,0	5,0	kW
Oil flow each bearing	0,0	15,0	l/min

NOTES : _____

1/1

FLENDER
GRAFFENSTADEN

SPECIAL PURPOSE GEAR UNITS
API 613 FIFTH EDITION
DATA SHEET SI UNITS

Job No. 41104 Item No. B
P.O. No. Date
Requisition No.
Inquiry No.
Revision 1 Date 06.03.2015 By HNI

O LUBRICATION REQUIREMENTS

☐ Oil system furnished by (2.6.3)
☐ Other ☐ Gear vendor
☐ Oil visc. cp @ 40°C cp @ 100°C (2.8.6)
☐ ISO Grade Load stage (2.2.6) 7,0

■ MESH

Mesh and windage power loss	2,0	kW
Oil flow, mesh	9,0	l/min

■ LUBRICATION REQUIREMENTS

Min. startup oil temperature	20,0	°C
Normal oil inlet temperature	60,0	°C
Maximum oil inlet temperature	65,0	°C
Unit oil flow (total)	64,0	l/min
Unit oil pressure	2,5	bar

☐ Oil visc. cp @ 40°C cp @ 100°C (2.8.6)
☐ ISO Grade 46 Load stage (2.2.6) 7,0

■ PIPING CONNECTIONS

Service	No.	Size	Type
Lube oil inlet	1	1,5 in.	ANSI 150 LBS
Lube oil outlet	1	6 in.	ANSI 150 LBS
Casing drain *			
Vent	1	1,5 in.	ANSI 150 LBS
Casing purge			

* Casing drain is 'dead bottom' housing drain, not lube oil outlet

O MOUNTING PLATES

☐ Gear furnished with (3.3.1.1)
☐ Baseplate ☐ Soleplate ☐ Subplate(s) (3.3.2.10)
☐ Mounting plates(s) furnished by (3.3.1.1)
☐ Baseplate leveling (3.3.2.3)
☐ Baseplate with leveling pads (3.3.2.3)
☐ Baseplate suitable for column mounting (3.3.2.4)
☐ Vendor review of purchaser's foundation dwgs. (2.1.13)
☐ Grout type (3.3.1.2.4)

O CONTRACT DATA

☐ Test data prior to shipment
☑ Progress report (5.3.3)
☐ Vendor signoff of inspector checklist (4.1.1.3)
☑ Information retained for 20 years (4.2.1.1) (4.2.2.6.1)
☐ Technical manual (5.3.5.4)
☑ PAINTING (4.4.3.1) ☑ Flender standard RAL5015 (blue)
☑ Painting housing interior not allowed (2.3.1.14)

O SHIPMENT

☐ Steel rotor storage container (4.4.5) ☐ Shaft covers (4.4.4)

	Contract unit	Spares
Export boxing	☐	☐
Domestic boxing	☐	☐
Outdoor storage over 6 mos.	☐	3 years indoor ☐ (4.4.3.9)

O ADDITIONAL REQUIREMENTS

O VIBRATION DETECTORS

RADIAL (3.4.2.1) (2.7.4.5) (2.7.4.6)
☑ Manufacturer BENTLY NEVADA ☑ Total No. 8
☑ X-Y probes pinion bearings ☑ Coupling end ☑ Blind end
☑ X-Y probes gear bearings ☑ Coupling end ☑ Blind end
☐ Other

AXIAL (3.4.2.1) (2.7.4.5) (2.7.4.6)
☑ Manufacturer BENTLY NEVADA ☑ Total No. 2
☐ Dual probes at each thrust bearing
☐ Single probe any shaft without thrust bearing
☐ Other

ONE EVENT PER REVOLUTION PROBE (2.7.4.5) (2.7.4.6)
☑ Manufacturer BENTLY NEVADA Total No. 2
☑ One on input shaft ☑ One on output shaft
☐ Other

ACCELEROMETER (3.4.2.1) (2.7.4.5) (2.7.4.6)
☑ Manufacturer BENTLY NEVADA ☑ No. required 2
☑ Pinion coupling end ☑ Gear coupling end
☐ Other

O TEMPERATURE DETECTORS

☐ Dial type thermometers (3.4.2.7)
☑ Type brg. temp. sensors (3.4.2.7) (2.7.1.3) PT100
☐ RTD ☐ Thermocouple / ☐ Simplex ☑ Duplex
Calibration Yes
☑ HS/LS bearings no. sensors each 2 / 2
☑ Thrust number of sensing elements each face 2

O OTHER VIBRATION AND TEMPERATURE

(3.4.2.5) (3.4.2.6)	Other	Gear vendor
Oscillator demodulator supplied by	☐	☑
Vibration monitor supplied by	☑	☐
☐ Vibration shutdown delay time seconds		
Temperature monitor supplied by	☑	☐
Oscillator demodulator J-box by	☑	☐
Temp. sensor termination J-box by	☑	☐

J-box type Mount

O MISCELLANEOUS

☑ Undamped critical analysis report (2.6.2.1)
☐ w/ dampd rotr respns analys rprt (2.6.2.4.3) (2.6.2.6)
Torsional analysis by (2.6.5.2) ☐ Gear vendor ☑ Other
☑ Spare set of gear rotors (4.3.2.4)
☐ Gear case furnished with inlet purge connection (2.4.3)
☐ Orientation of oil inlet & drain conns. (2.4.6)
☑ Filter breather location (2.3.1.12) Prov. on upper casing
☐ Torsional device provisions (2.5.4.5)
☐ Rotor vertical storage provisions (2.5.4.8)
☐ Rotor vertical storage fixture(s) (3.6.2)
☐ Vendor service rep. on site (2.1.13)

1/1

FLENDER
GRAFFENSTADEN

SPECIAL PURPOSE GEAR UNITS
API 613 FIFTH EDITION
DATA SHEET SI UNITS

Job No. 41104 Item No. B
P.O. No. Date
Requisition No.
Inquiry No.
Revision 1 Date 06.03.2015 By HNI

O INSPECTIONS AND TESTS (4.1)

☐ Advance notice of witness testing required (4.1.3)
Number calender days

	Req'd	Witness	Observe	Test Log
Shop Inspection (4.1.1)	☐	☐	☐	
Cleanliness Inspection (4.2.3.1)	☐	☐	☐	
Hardness Verification (4.2.3.3)	☑	☐	☐	☑
Dismantle-reassembly (4.3.2.3.1)	☑	☐	☐	☐
Contact Check (2.5.2.2)	☑	☐	☐	☐
Contact Check Tape Lift (2.5.2.2)	☑	☐	☐	☑
Gear accuracy check (2.5.2.1)	☑	☐	☐	☐
Double helical axial stability (2.5.2.3)	☑	☐	☐	☑
Special testing integral forged gears (2.5.3.3) (testing per mutual agreement)	☐	☐	☐	☐
Residual unbalance check (2.6.6.2)	☑	☐	☐	☑
Mechanical Run Test (Main) (4.3.2)	☑	☐	☐	☑
Mechanical Run Test (Spare) (4.3.2.4)	☐	☐	☐	☐
Addl. Mechanical Tests (4.3.2.2.16)	☐	☐	☐	☐
Part or Full Load And Full Speed Test (4.3.3.1)	☐	☐	☐	☐
Full torque, reduced speed (4.3.3.2)	☐	☐	☐	☐
Full Torque Static Test (4.3.3.3)	☐	☐	☐	☐
Back-To-Back Locked Torque Test (4.3.3.4)	☐	☐	☐	☐
Sound Level Test (4.3.3.5)	☑	☐	☐	☑
Additional gear tooth test (4.2.2.8)	☐	☐	☐	☐
Use shop Lube System	☑	☐	☐	
Use job lube system	☐	☐	☐	
Use shop Vibration Probes, Etc.	☐	☐	☐	
Use job Vibration Probes, Etc.	☑	☐	☐	
Final Assembly, Maintenance & Running Clearance (4.2.1.1.e)	☑	☐	☐	☑
Oil System Cleanliness (4.2.3.2)	☐	☐	☐	
Oil System-Casing Joint Tightness (4.3.2.1.4)	☐	☐	☐	
Warning And Protection Devices (4.3.2.1.5)	☐	☐	☐	
Seismic Vibration Data (4.3.2.2.3)	☐	☐	☐	☐
Vibration, Phase Plots (4.3.2.2.12)	☑	☐	☐	☑
Oil Inlet Range test (4.3.2.2.13)	☐	☐	☐	☐
Tape recorded Vibration Data (4.3.2.2.14) (4.3.2.2.15)	☑	☐	☐	☑
	☐ Purchaser copy			

NON-DESTRUCTIVE TESTING (4.2.1.2) (4.2.2.1)

	Surface	Sub surface		Log
☐ Casing	☐	☐		☐
☑ Rot. Elemts.	☑	☑		☑
☑ Bearings	☑	☑		☑
☐ Other :	☐	☐		☐

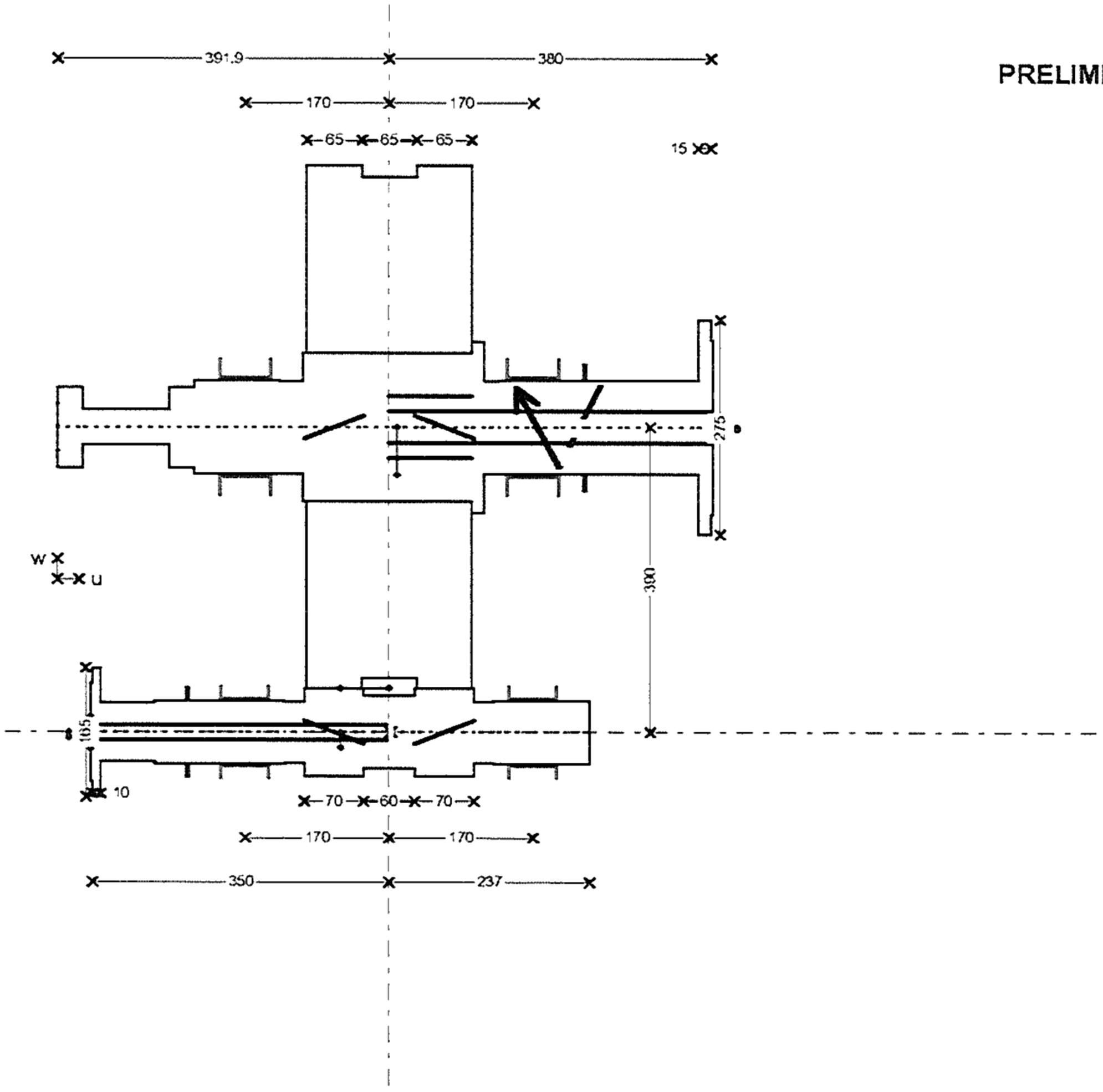
(Specify)

NOTES :

During start-up, gears can exhibit a transient spike reading of vibration levels that will exceed shutdown settings. Therefore a trip multiplier is recommended in the control system.

Mechanical running test duration 4 hours including
- Shaft vibration record using job vibration probes if ordered
- Bearings temperature records
- Casing vibration measurement
- Sound level pressure measurement
- Power losses measurement at oil outlet
- Performed with oil ISO VG 32

Oil flow requirement and power losses are calculated values only, add normal safety margins for sizing heat exchangers.



FLENDER
GRAFFENSTADEN

PRELIMINARY MASS ELASTIC DATA

Customer : Siemens AG Duisburg
Destination : Khursaniyah Al Fadhili
Purchaser order :
F-G job number : D 41104B1 OL:
Type and serial N° : TX40/5C

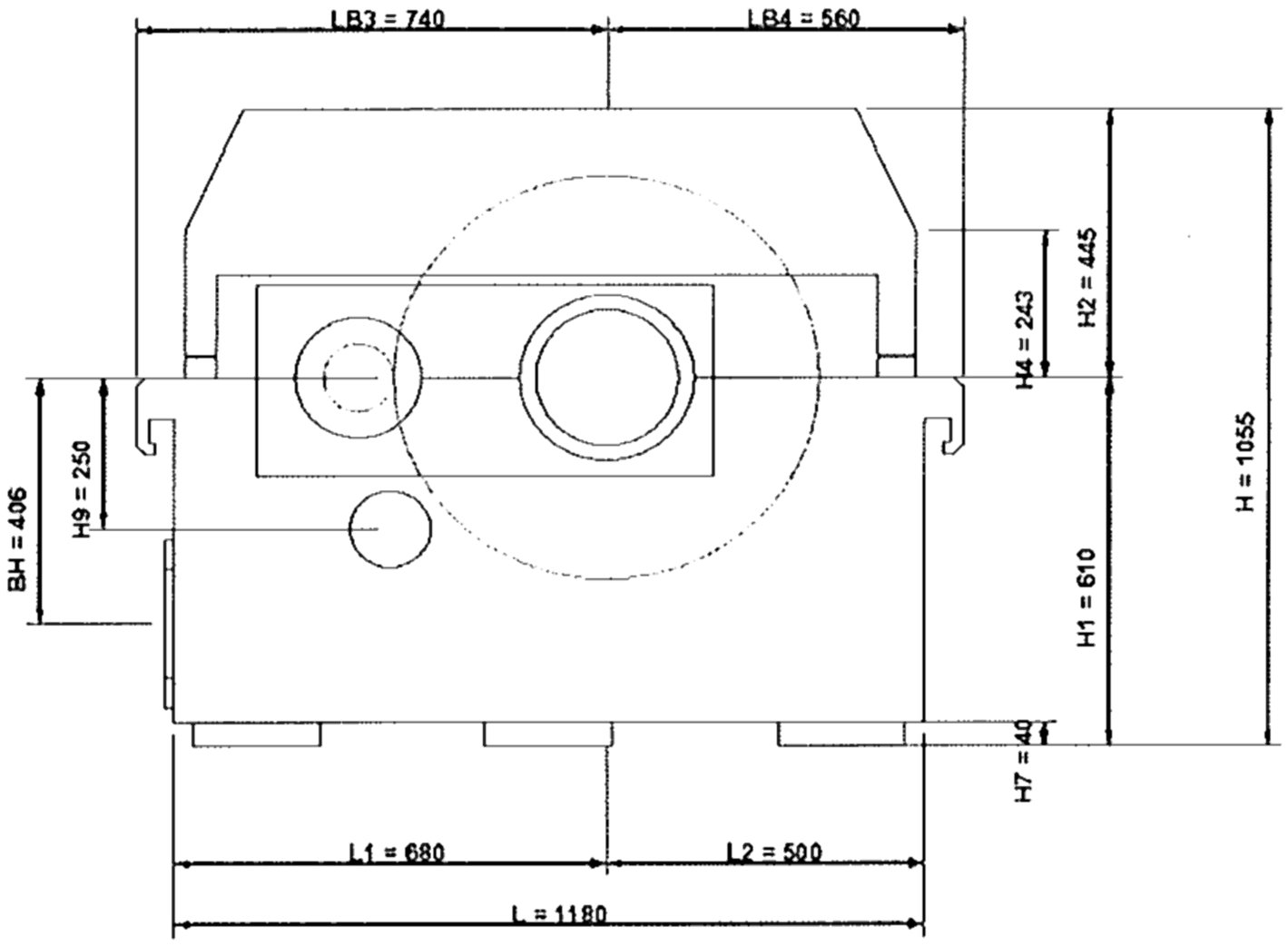
Power rating : 1620 kW
Service factor : API613/03 >=1,4
Input speed : 1800 rpm
Output speed : 10737,9 rpm
Speed ratio : 5,96

Weight HSS : 30,5 kg
Weight pos. from teeth middle HSS : -57,5 mm
Inertia HSS : 0,038 Kg.m²
Stiffness HSS : 1,11 MNm/rd
Bearing type 1 : Tilting pads 80 x 56
Bearing type 2 : Tilting pads 80 x 56
Add. weight on brg. side 1 : 10,4 kg

Weight LSS : 574,3 kg
Weight pos. from teeth middle LSS : 9 mm
Inertia LSS : 28,526 Kg.m²
Stiffness LSS : 6,5 MNm/rd
Bearing type 4 : Cylindrical 120 x 60
Bearing type 3 : Cylindrical 120 x 60
Add. weight on brg. side 4 : 26,4 kg

Positive direction of external

APPAREIL.xls _ Edition du :06.03.2015
1/1


LB3 = 740
LB4 = 560
H4 = 243
H2 = 445
H = 1055
H1 = 610
H7 = 40
BH = 406
H9 = 250
L1 = 680
L2 = 500
L = 1180

165
10
350
277
275
447
380
275
15
L4 = 209
E = 390
275

ADDITIONAL TECHNICAL DATASHEET

Job No. 41104 Item No. B
P.O. No Date
Requisition No.
Inquiry No.
Revision 1 Date 06.03.2015 By HNI

☑ ADDITIONAL GEAR DATA

Efficiency

Percent of rated power	Efficiency
100%	98,70
75%	98,56
50%	98,38
25%	97,42
10%	87,68

Losses

Power loss at no load kW
Heat rejection kcal/h

☐ PUMP DETAILS (Dimensioning is preliminary !)

Design :
Speed : rpm
Oil flow : l/min
Oil pressure : bar
NPSH : m
Safety valve :
Driving method :
Material :
Flanges :
Testing :
Furniture of ATEX certificate :

☐ TURNING GEAR (Dimensioning is preliminary !)

Calculation results

Required turning speed rpm
Actual turning speed rpm
Required breakaway torque Nm
Actual breakaway torque Nm
Actual maximun torque Nm
Actual acceleration time s

Motor

Supplier
Power kW
Voltage V
Frequency Hz
Speed rpm
Electric standard

Turning gear

Type
Ratio

Clutch

Type
Max. allowable torque Nm

Miscellaneous

Starting device
Switch details

☑ INSTRUMENTATION PACKAGE

Thermometer

	Bearing	Thrust bearing	Oil inlet/outlet
Qty			
Type			

Thermoelements

	Bearing	Thrust bearing	Oil inlet/outlet
Type	DUPLEX 2x3F	DUPLEX 2x3F	
Classification	IEC60751	IEC60751	
Removable from the outside	NO	NO	
ATEX	ATEX Eexia	ATEX Eexia	

Shaft vibrations

	Radial	Axial		Keyphasor	Accelerometer
Type	B.N. 3300 XL 8mm Sys. 9M	HS	No	B.N. 3300 XL 8mm Sys. 9M	ACCELEROMETER BENTLY
		LS	BENTLY NEVADA 3300 XL 8mm Sys. 9M		
Probe	Yes	HS	No	Yes	
		LS	Yes		
Proximitor	Yes	HS	No	Yes	
		LS	Yes		
Probe holder	Yes	HS	No	Yes	
		LS	Yes		
Connection head	Yes	HS	No	Yes	
		LS	Yes		
mounting kit					Yes

Junction box(es)

Qty 0
Manufacturer
Material
ATEX None

Miscellaneous

Identification ☑ wire ☑ conduit ☐ junction box
Conduit type
Transmitter type Qty
Terminal block type Qty

FLENDER
GRAFFENSTADEN

FLENDER-GRAFFENSTADEN S.A., FRANCE
BP 84, F-67402 ILLKIRCH-CEDEX
1, rue du Vieux Moulin
F-67400 ILLKIRCH-GRAFFENSTADEN

Commercial Conditions

- Prices are quoted FCA Illkirch-Graffenstaden following Incoterms 2010 including packing cat 1A of SEI, 1999 issue, ind. 2.
- Progress payments : 100% at delivery.
- This quotation is subjected to the Flender Graffenstaden Standard Terms and Conditions of Sales and valid for acceptance until the 15th of July 2015.
- Where approval of drawings is required, approval must be in line with the document schedule.
- Warranty period is 18 months of operation or 24 months after delivery whichever occurs first. We recommend the supervision of our engineer for the commissioning.
- Flender-Graffenstaden SAS shall not be obligated to fulfill this agreement if such fulfillment is prevented by any impediments arising out of national or international foreign trade or customs requirements or any embargoes or other sanctions.

Applicable documents for the quotation *(available on demands)*

Documents schedule,
Quality plan
Painting standard,
Standard Terms and Conditions of Sales

We thank you for the opportunity of quoting and look forward to the pleasure of serving you.

Very truly yours,

N. HOST
(Project Engineer)

Y. FRIEDMANN
(Sales Manager)

Generated with CAMEC V 4.9.5 26 Fev 2014

***** "This quotation is subject to confidentiality. Information thereof may not be shared with or forwarded to any third parties!"***