

Appendix A2 –TORQUE CALCULATIONS

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 Eskom Koeberg Torque and Data Sheet

Unit 2 Trigramme 2LHJ201TY CE Number CE-15816

Position of Gasket

Gasket Type Laminated Graphite PSM

Gasket Dimensions

Outside Diameter of Gasket Material - 55 mm

Inner Diameter of Gasket Material - 35 mm

Thickness of Gasket Material - 4 mm

Bolting and Flange Details

Number of Bolts - 4

Bolt Size - M16

Bolt Material - A2-70

Flange Configuration - Raised Face

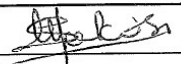
System Details

System Design Pressure (MPa) 3 MPa

System Design Temperature 50 Degrees Celcius

Comments

Torque 80 Nm

	Name	Date	Signature
Compiled	C Mbiyo	16 October 2015	
Reviewed	L Pillay	16 October 2015	
Authorised	M. Mooketsi	16 October 2015	

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 Eskom Koeberg Torque and Data Sheet

Unit 2 Trigramme 2LHJ035VA CE Number CE-15815

Position of Gasket

Gasket Type Laminated Graphite PSM

Gasket Dimensions

Outside Diameter of Gasket Material - 50 mm

Inner Diameter of Gasket Material - 25 mm

Thickness of Gasket Material - 4 mm

Bolting and Flange Details

Number of Bolts - 4

Bolt Size - M16

Bolt Material - A2-70

Flange Configuration - Raised Face

System Details

System Design Pressure (MPa) 3 MPa

System Design Temperature 50 Degrees Celcius

Comments

Torque 80 Nm

	Name	Date	Signature
Compiled	C Mbiyo	16 October 2015	
Reviewed	L Pillay	16 October 2015	
Authorised	M Moeketsi	16 October 2015	

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Trigramme		LHj 201TY	
Graphite Laminate PSM		3	
Gasket Details			
Type	4		
	Imperial		Metric
OD	2.17 in		55.00 mm
ID	1.38 in		35.00 mm
t (thickness)	0.08 in		2.00 mm
Does gasket have bolt holes?			no
Bolt/stud Details			
ND			16.00 mm
pitch			2.00 mm
n (No. of bolts)			4.00
Material (Bolt grade)			A2-70
System Temperature			50.0 °C
Bolt Yield Stress (Minimum) (Not B8T: Class 2)			450.00 MPa
Is lubrication used for bolts (Yes/No)			yes
Coefficient of friction			0.14
Design Pressure (Pd)	435.11 psi		3.00 MPa
Test Pressure (Pt)	652.67 psi		4.50 MPa
Gb	1400.00 psi		9.65 MPa
a	0.32		0.38
Gs	0.01 psi		0.00 MPa
Flange Details			
Pound series			300 lbs
Size (inches)			1 "
Calculation Results			
N (actual width)	0.39 in		10.00 mm
b (Effective width)	0.20 in		5.00 mm
G (Effective diameter)	1.77 in		45.00 mm
Ai (Hydraulic Pressure area)	2.47 in ²		1590.43 mm ²
Ag (Full gasket seating area)	2.19 in ²		1413.72 mm ²
Ai/Ag	1.12		1.13
e (Assembly efficiency)	0.75		0.75
Bolt/Stud Calc according to Shigley, JE, Pg 293			
Minor Diameter			13.55 mm
Pitch Diameter			14.70 mm
Stress Diameter			14.12 mm
Ab (Minor diameter area)			144.12 mm ²
At (Tensile stress area)			156.67 mm ²
Tightness Class			
C (for T3)	10.00		10.00
Tpmin (minimum tightness)	540.85		3.73
Tpa (Assembly tightness)	811.27		5.59
Tr	1.06		
Sm1 (Design gasket stress for required operating tid)	5249.88 psi		36.20 MPa
Sm2 (Design gasket stress related to initial seating c)	10413.47 psi		71.80 MPa
			2.00
Sm1/Pd			12.07
Sm2/Pd			23.93
Mo (Design Factor)			23.93
Wmo (Minimum required bolt load)	23891.30 lbf		106273.80 N
Stress Area			156.67 mm ²
Bolt Stress to satisfy gasket requirements			169.58 MPa
Bolt Stress at 50% & 80% bolt yield	234.59 MPa		375.34 MPa
Maximum allowable bolt preload stress			276.00 MPa
Min. torque to satisfy gasket requirements			50.39 Nm
Torque at 60% of bolt yield	Sya (Min. initial gasket assembly stress)		83.64 Nm
	Torque recommended		80 Nm
	Bolt preload stress		269.25 MPa
	% of bolt yield		57.39 %

If the initial bolt stress is too low, any subsequent reduction in thickness of the gasket due to creep will quickly result in loss of bolt strain and subsequent leakage.
Bolt stress less than 50% of yield should only be considered under certain conditions.

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Trigramme		LHJ 035VA	
Graphite Laminate PSM		3	
Gasket Details			
Type	4		
	Imperial		Metric
OD	1.97 in		50.00 mm
ID	0.98 in		25.00 mm
t (thickness)	0.08 in		2.00 mm
Does gasket have bolt holes?			no
Bolt/stud Details			
ND			16.00 mm
pitch			2.00 mm
n (No. of bolts)			4.00
Material (Bolt grade)			A2-70
System Temperature			50.0 °C
Bolt Yield Stress (Minimum) (Not B8T: Class 2)			450.00 MPa
Is lubrication used for bolts (Yes/No)			yes
Coefficient of friction			0.14
Design Pressure (Pd)	435.11 psi		3.00 MPa
Test Pressure (Pt)	652.67 psi		4.50 MPa
Gb	1400.00 psi		9.65 MPa
a	0.32		0.38
Gs	0.01 psi		0.00 MPa
Flange Details			
Pound series			300 lbs
Size (inches)			1 "
Calculation Results			
N (actual width)	0.49 in		12.50 mm
b (Effective width)	0.25 in		6.25 mm
G (Effective diameter)	1.48 in		37.50 mm
Ai (Hydraulic Pressure area)	1.71 in ²		1104.47 mm ²
Ag (Full gasket seating area)	2.28 in ²		1472.62 mm ²
Ai/Ag	0.75		0.75
e (Assembly efficiency)	0.75		0.75
Bolt/Stud Calc according to Shigley, JE, Pg 293			
Minor Diameter			13.55 mm
Pitch Diameter			14.70 mm
Stress Diameter			14.12 mm
Ab (Minor diameter area)			144.12 mm ²
At (Tensile stress area)			156.67 mm ²
Tightness Class			
C (for T3)	10.00		10.00
Tpmin (minimum tightness)	540.85		3.73
Tpa (Assembly tightness)	811.27		5.59
Tr	1.06		
Sm1 (Design gasket stress for required operating t	5249.88 psi		36.20 MPa
Sm2 (Design gasket stress related to initial seating c	10576.64 psi		72.92 MPa
			2.00
Sm1/Pd			12.07
Sm2/Pd			24.31
Mo (Design Factor)			24.31
Wmo (Minimum required bolt load)	24886.77 lbf		110701.87 N
Stress Area			156.67 mm ²
Bolt Stress to satisfy gasket requirements			176.65 MPa
Bolt Stress at 50% & 80% bolt yield	234.59 MPa		375.34 MPa
Maximum allowable bolt preload stress			276.00 MPa
Min. torque to satisfy gasket requirements			
Sya (Min. initial gasket assembly stress)			83.64 Nm
Torque at 60% of bolt yield			
Torque recommended			80 Nm
Bolt preload stress			269.25 MPa
% of bolt yield			57.39 %

If the initial bolt stress is too low, any subsequent reduction in thickness of the gasket due to creep will quickly result in loss of bolt strain and subsequent leakage.
Bolt stress less than 50% of yield should only be considered under certain conditions.

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