HS 252 - STANDARD ASSEMBLY TORQUES

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REVISION LOG

Rev.	Remarks
82	Added 315 N-m** Torque to Cam Follower 2739013
81	Section 17.13 – New EV9 control valve added (HPN 13078474)
80	Section 14 – Reduced torque values for brass and other soft metal fittings added. Table 19 – HGT-FT BSPP Plugs updated to include hollow hex plugs
79	Added Table 31 – Torque for Diffuser Hose Clamp
78	Added Section 17.15 – Vibration Mounts
77	Added Section 17.14 – Torque values for IGUS CFX Clamps
76	Table 30 – Heavy-Duty Hose Clamp (T-Bolt Style). Model number and torque values updated
75	Added Section 17.13 – Torque value for EV9 Flow Control Valve (HPN 7610661)
74	Added Section 17.8.1 – Torque value for Hydac Differential Pressure Transmitter (HPN 6404099). Torque values for orifices on hydraulic manifolds added (See Table 27). Torque values for gas valves added (See Section 17.12)
73	Updated torque for heater bands which have corrugated sheet metal on the outside diameter and also having an M6 clamping screw (Section 15, Table 22). Also updated torque values in section 17.7 for the Hydac oil level sight gauge to align with supplier specification.
72	Updated torque requirements for EOAT Tube Retainer Pins in section 19.2. Section 17.8 Torque values for Hydac PTs reviewed with Hydac (Feb. 16, 2022) and increased from 20 N-m to 40 N-m. The purpose of the increased torque is to reduce/eliminate oil leakage from PT and fitting interface. Both Hydac and Husky test results show insignificant effect of increased torque on PT performance (i.e. insignificant null point shift).

71	Added section 19.13: Torque Specification for NexPET Core Sleeve Set Screws. DLO specifications updated (2205)
70	Updated CoolPik Vacuum/Blow Pin Torque Specifications Table 40 with values for M20 blow pins
69	Removed Adhesive info and moved to HS 897 – Adhesive Standard. Left Torque/Loctite info for clamp fasteners.
68	Section 17.08 Torque values added for new Hydac PT HPN 9247632
67	Lubrication notes added to section 14 - Torque values for fittings (HGT-FT)
66	Section 14 Torque values for fittings (HGT-FT) reviewed and updated: Section 14.1 relocated and revised to clarify assembly lubrication practices. Tables 12, 13, 14, 15, 18 and 19 updated as per the latest industry standards from Parker and Manuli. Section 17.11 added: Torque value for male pressure test point specified as per latest Hydac catalog.
65	ORFS hose end fittings specifications: Increased torque values in table 13. Note: Previous torque values were too low especially for the smaller sizes and failed a pull test audit. Manuli torque values for nut tightening have been tested and approved. Warning: Husky torque specifications apply to lubricated parts while Manuli's apply in dry conditions. As a result, Husky exceeds Manuli's recommended preload. DLO Details 2015 specifications: Sheet 1: Added Spade terminal "S0" and "S8" Code. Sheet 6: HPN 7404990 updated AWG and Torque value. HPN 5832899 updated AWG value. Sheet 8: Added * Larger termination screws Sheet 10: HPN 2172625 added load side termination details Sheet 11: Added HPN 2351717 Sheet 12: Added HPN 6344019 Sheet 14: Added HPN 8425223
64	DLO Details 1933 table updated to reflect current product usage along with torque value consolidation - See section 15 or DLO Details (English) 1937 or DLO Details (Chinese) 1937 specifications
63	DLO device torque specifications changes (DLO Details 1933) - See section 15 or HGT-EL DLO
62	Unit changed from ft-lb to in-lb in Table 22 - HGT-EL Metric and Imperial Screws, Mounting Hardware (Electrical Applications) to align with other tables and tooling in use
61	HF and Cxx stopper code notes updated in HGT-EL DLO
60	Section 17.6 Added value for 2.5" G2 Section 17.5 Updated table for DBDS relief valves
59	Added Section 17.10 for Numatics air valve assemblies
58	Section 17.8 updated. Old Hydac pressure transducer (HPN 3875996) replaced with new (HPN 7980938)
57	Added torques for Stopflex hose bands and heavy-duty hose clamp (T-Bolt style)
56	Added torque for electrical cabinet door ground stud
55	Updated as per SR 51455: Added note/picture for Cold Half and Hot Runner Mounting to Machine Platen in Husky General Torque (HGT) - Standard Applications
54	Updated as per SR 50799: Added sections 19.9, 19.10, 19.11, 19.12. Updated Sections 19.5, 19.6, 19.7, 19.9. Replaced and moved the table from section 19.7 to section 19.8
53	Added torque specifications for Premolded Cables, Electrical Applications). Bookmarks to multiple tables added. Table for HGT-35 specifications updated (Stainless steel A2, socket head cap screw application added)
52	Table for HGT-EL Heater Bands, Electrical Applications updated. Torque values for UNC # 1/4 - 20 spider straps and post terminal nut added. Torque values for Danfoss pressure transducers added (see section 17.9)
51	Added torque specifications for Neck Ring Plugs
50	Section 15 – HGT-EL Heater Bands, Electrical Applications updated. Torque value applied to ground stud nut specified.
49	Section 4 – References updated for HGT 80, 50 and 35 torque calculations (units of measure added)

48	Torque value for solid state relay added
47	2739013 CAM follower torque specifications updated
46	Table 1 updated and new Figure 1 added to clarify Husky General Torque Standard Applications (#1 to 8)
45	Torque values for Watlow heater bands added
44	Updated torque values for Watlow heater bands, torque values for Hydac oil level indicators added (see section 17.7), torque values for Hydac pressure transducers added (see section 17.8). HGT-EL DLO updated as per latest master
43	Updated torque values for HGT-LHCS (Low Head Cap Screws)
42	Section 19.1
41	Baumuller torque values in HGT-EL DLO updated to reflect mid-range torque values
40	Minor addition to sheet 6 in HGT-EL DLO as per manufacturing request
39	HGT-LHCS (Low Head Cap Screws) specifications added (section 13). Warning section added (section 5)
38	Section 13 updated (HGL-EL). Torque values for DLO related connections removed and consolidated into a separate document: HGT-EL DLO
37	Updated torque values for COOLPIK blow/vacuum pins in section 19.3 . Reference SIR 105554
36	Torque values for heater bands added/updated
35	Added note that states: “this document has a duplicate copy that’s published to www.husky.co, all future revisions must be posted to www. husky.ca”
34	Reference to Ampco 18 mounting screws removed
33	Added screw interchangeability notes in tables 4, 5, 6, and 8. Added screw interchangeability warning in section 5
32	Added new Section 17 for PET Mold and Hot Runner Special Torque Applications
31	Tables under section 15.8 reformatted (bladder accumulator neck adaptor specifications)
30	Torque values for accumulator neck adaptors added
29	Application notes (section 5.1) reviewed and updated: Torque values for high temperature applications (>150°C) statement clarified
28	HGT-EL torque values for Breakers, fuses and lugs updated
27	Baumueller BM44XX Servo Drive Torque values added
26	Torque values for SAE plugs reviewed and updated
25	CAM follower torque values have been in Section 15.7
24	Torque values added to HGT-EL Lugged Connections - Electrical Applications
23	Torque values for SAE plugs updated
22	Torque values for Siemens 5SY series breaker added
21	Torque values for Woehner and Ferraz Shawmut fuse holder added
20	Torques for Bosch Rexroth DBDS pressure relief valves added (see section 17.5)
19	Lubricants section removed (transferred to HS 609)
18	Section 7.1, gearbox oil added
17	Hoist ring torquing requirements updated (SR 13841)
16	Remove note in revision 15
15	Add note for 4mm socket option for M10 (see section 10, B note)
14	Updated ‘Table 1 – Husky General Torque Standards Applications’: HR and Mold Liftbars with M30 installations to use HGT-35 – SR13141
13	Updated ‘Table 1 – Husky General Torque Standards Applications’: HR Liftbars to use HGT-50 as well – SR13141
12	Torques for electrical components added. References to “Husky Classes” added (e.g. Unbrako, Holokrome, YFS, etc. socket head cap screws).
11	Added applications notes for adhesives usage and selection (section 7.2.1 and 7.2.2 added)

10	Table 1 and application notes (section 5.1) updated to clarify the default preload (HGT-80, 50 or 35). Drawing specifications section updated (see section 14). Torque table shown on assembly drawings replaced by a note referring to the HS 252.
9	Approved hydraulic oils specified in HS 207. Reference to HS207 added to “Lubricants for General Application” section (Table 2). Note: table 2 transferred to HS 609 (see revision 19)
8	Added Manuli hose fittings, torque tolerances changed to +/-4% (section 6 updated)
7	Torque values applied to threaded rod applications and maximum allowable preload on 10.9 fasteners
6	New torque chart for AMPCO 18 applications added (see section 15.5), FFWR torque values for ORFS fittings added
5	Section 4 references added, section 6 torque tolerances added, tolerance values reviewed by tool supplier, document title changed.
4	New standard template used, torque values for SAE plugs updated, bulkhead locknut torque values added, torque for BSPT fittings and plugs added, lubricant section modified, torque tolerances added, etc.
3	Torque values for grade 10.9 and 12.9 screws consolidated, torque values for hydraulic applications and split flanges added, drawing specifications section updated, etc.
2	New format, new part numbers for FGL-2 grease, updated notes and units of measure
1	Published to Site
0	Original Issue

1 SCOPE

HGT (Husky General Torque) is a general torque standard that applies to threaded connections that do not have their respective torque values indicated on the drawing. Any other torque values such as the supplier's recommended torque specifications specified in Section 17 or any other deviations from the general standard must be individually specified on the drawing. Any deviations from this standard must be justified by calculations.

2 PURPOSE

To provide a list of general torque values and lubrication practices to be used on Husky product.

3 DOCUMENT CONTROL

Revisions to this document shall be authorized by Corporate Operations.

4 REFERENCES

The torque values specified in this document come from the following Industry Standards, Suppliers Catalogs and/or formulae:

HGT-80 Metric Fasteners	$T = K.F.d$ - Torque T in Newton-meter - Coefficient of friction $\mu = 0.12$ - Torque coefficient K $(0.15 \leq K \leq 0.17)$ - Induced screw load F in Newton - Nominal diameter d in meter - ISO 898-1 (grades 12.9 & 10.9) and ASTM A574	Standard proofload ratios: 80, 50 and 35%. E.g. 80% preload means that the torque will produce enough energy to achieve 80% of what the bolt is capable of without permanent deformation.
HGT-80 Imperial Fasteners		
HGT-50 Metric Fasteners		
HGT-50 Imperial Fasteners		
HGT-35 Metric Fasteners		
HGT-35 Imperial Fasteners		
HGT-SS Metric Set Screws	ISO 898/5-1980 Table 5 and ASTM F912-1986 Table 2	
HGT-SS Imperial Screws	ASTM F912-1986	
HGT-LHCS Metric Screws	Torque values provided by manufacturer	
HGT-FT ORFS Tube Ends	Parker Catalog 4300 (April 2017)	
HGT-FT SAE and BSPP Ends	Parker Catalog 4300 (April 2017)	
HGT-FT ORFS Hose Ends	Manuli Hydraulics catalog 2020	
HGT-FT JIC Ends	Parker Catalog 4300 (April 2017)	
HGT-FT NPT and BSPT Plugs and Fittings	Parker Catalog 4300 (April 2017)	
HGT-FT Flareless Tube Ends	Parker Catalog 4300 (April 2017)	
HGT-FT SAE Plugs	Parker Catalog 4300 (April 2017)	
HGT-FT Bulkhead Locknuts	Parker Catalog 4300 (April 2017)	
HGT-FT BSPP Plugs	Former Luxembourg Machine torque standard (LTML111)	
HGT-FT Metric Plugs	Former Luxembourg Machine torque standard (LTML111)	
HGT-EL Metric and Imperial Screws	Electric Components Supplier	
Torque for Hydraulic Valves Mounting Bolts	Torque values provided by manufacturer	
Torque for Orifices on Hydraulic Manifolds	Former Luxembourg Machine torque standard (LTML111)	
Torque for Hose/Pipe Clamps Mounting Bolts	Former Luxembourg Machine torque standard (LTML111)	
Torques for Hydraulic Motors Mounting Bolts	Torque values provided by manufacturer	
Code 61 Split Flange Assemblies	ISO 6162-1994	
AMPCO 18 Applications	Torque values provided by manufacturer	
Code 62 Split Flange Assemblies	ISO 6162-1994	

5 WARNINGS

Always use the correct parts and the proper torques. Incorrect fastener connections can dangerously weaken assemblies. Ensure that all safety information, instructions and warnings such as shown in the two examples below are read and understood before any operation or any maintenance procedures are performed.

CAUTION!
Mechanical hazard – risk of equipment damage. Use of improper torque can result in equipment damage. Consult the assembly drawings for the torque specifications before referring to the torque charts in this section.

WARNING!
Molten plastic spray hazard - risk of serious injury and equipment damage. If incorrectly sized screws are used, equipment damage may occur that could result in uncontained molten plastic spray. If replacing the screws, only use the screw sizes specified in the machine bill of material.

6 APPLICATIONS

HGT consists of seven torque standards HGT-80, HGT-50, HGT-35, HGT-SS, HGT-LHCS, HGT-FT and HGT-EL as shown in Table 1. For mechanical applications, screws are torqued to the HGT-80, HGT-50, HGT-35 or HGT-LHCS standards. For electrical applications, screws and other components are torqued to the HGT-EL standard. Set screws are torqued to the HGT-SS standard and fittings to the HGT-FT standard. Deviations from Husky General Torque Standards for Special PET Mold and Hot Runner applications are listed below and are cited in detail in section 19.

Figure 1 – Husky General Torque (HGT) - Standard Applications (# 1 to 8)

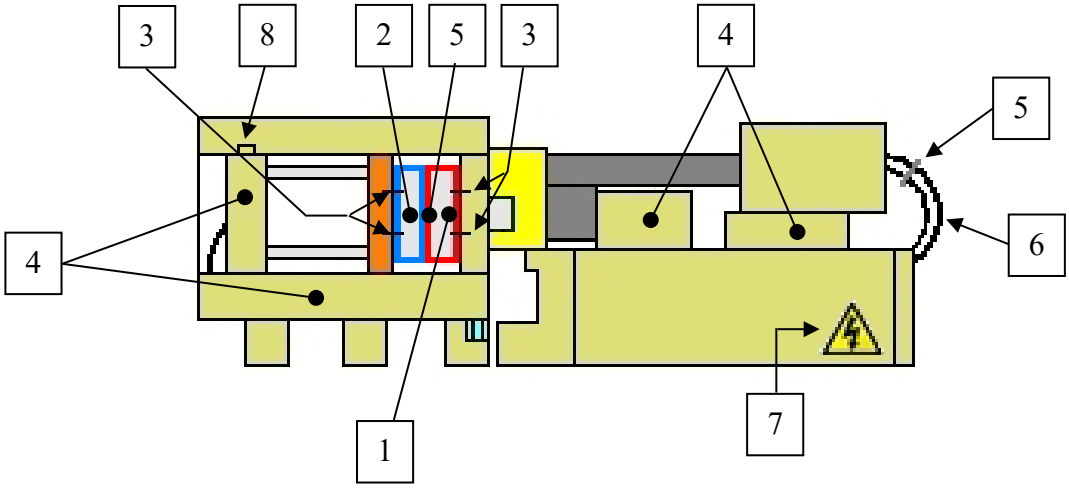

Table 1 – Husky General Torque (HGT) - Standard Applications

Application		Hardware		Base/Threaded Material	Torque Standard
Mechanical	**Hot Runner Assemblies** 1	Screws and Threaded Rods	- DIN 912-12.9 SHCS* - DURLOK-12.9-UNB HHS - DIN 976-12.9 ROD	Steel Cast Iron	HGT-80
		Set Screws	- ISO 898/5-45H - ASTM F912	N/A	HGT-SS
		Low Head Cap Screws	- DIN 7984	N/A	HGT-LHCS
	Cold Half Assemblies (including Cavity plate assembly) 2	Screws and Threaded Rods	- DIN 912-12.9 SHCS* - DURLOK-12.9-UNB HHS - DIN 933 & 931-10.9 HHCS - DIN 976-12.9&10.9 ROD	Steel Cast Iron	HGT-50
		Set Screws	- ISO 898/5-45H - ASTM F912	N/A	HGT-SS
		Low Head Cap Screws	- DIN 7984-10.9 LHCS	N/A	HGT-LHCS
	Cold Half and Hot Runner Mounting to Machine Platen 3	SHCS	- DIN 912-12.9 SHCS*	Cast Iron	HGT-50**

* Referred to as "Husky Classes 1, 2, 3 & 4" in HS 258

** When using hex tool adapter to access mold mounting screws, no de-rating of torque value is required - See Figure 2

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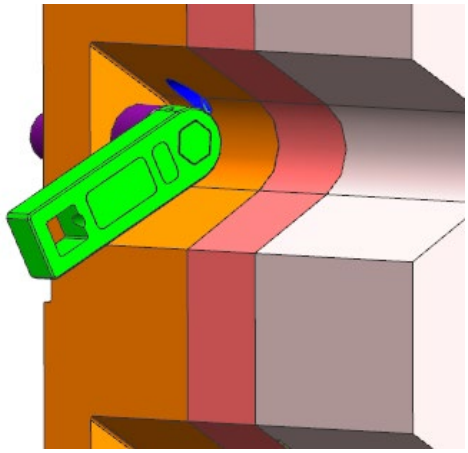
Application		Hardware		Base/Threaded Material	Torque Standard
Mechanical	Machine Assemblies 4	Screws and Threaded Rods	- DIN 912-12.9 SHCS* - DURLOK-12.9-UNB HHS - DIN 933 & 931-10.9 HHCS - DIN 976-12.9&10.9 ROD - ASTM A574 SHCS	Steel Cast Iron	HGT-50
		Set Screws	- ISO 898/5-45H - ASTM F912	N/A	HGT-SS
	All Assemblies Using a Weaker Base Material 5	Screws and Threaded Rods	- DIN 912-12.9 SHCS* - DURLOK-12.9-UNB HHS - DIN 933 & 931-10.9 HHCS - DIN 976-12.9&10.9 ROD - DIN 7991-10.9 FHCS - ISO 7380-10.9 BHCS - ASTM A574 SHCS	Cast Aluminum, Aluminum Plate	HGT-35
6 Hydraulic, Lubrication, Air and Water		Hose and Tube Fittings	- O-ring face Seal - JIC (37° Flared) - NPT, BSPP, Bite - SAE Straight Thread	N/A	HGT-FT
7 Electrical		Screws and other components	- Steel, Al& Cu, Brass screws	N/A	HGT-EL
8 Hoist Rings		Screws	- As supplied with Hoist Ring	N/A	Follow Supplier recommendation

* Referred to as “Husky Classes 1, 2, 3 & 4” in HS 258

Figure 2 – Using Hex Tool Adapter to Access Mold Mounting Screws



6.1 APPLICATION NOTES

- Washers are recommended for oversized holes and slots.
- Heavy washers (DIN 7349) are recommended for cast aluminum applications.
- The HGT-80 standard is recommended for the majority of Hot Runner products: These high strength and/or high fatigue applications use grade 12.9 bolts that will not crush, gall, warp or fracture the joint material under preload (e.g. high-strength alloy steel).
- The HGT-50 standard is recommended for the majority of Machine and Mold product applications. HGT-50 ensures that the area below the screw head does not bear into the seating material and the threads do no shear upon torquing.
- The HGT-35 standard is recommended for those applications where the yield strength of the base material would otherwise be exceeded under a 50% preload. An example is clamping a cantilevered section such as a belt clamp that is subject to bending stress.
- Torque values for high temperature applications (>150°C) should be calculated and individually specified on the drawing as required. If no values are indicated on the drawing, the general HGT standard should be used (e.g. HGT-50 for Machine and Mold applications, HGT-80 for Hot Runner applications).
- In all applications the joint must be designed to carry the load safely and without separation.
- Screw sizes and torque values must be supported by calculations for externally applied loads that are subjected to fatigue action such as pressurized vessels.
- When maintenance or service requires the replacement of screws, it is recommended that they be the same ones specified in the machine Bill of Material. Due to the interchangeability between some metric and imperial screws, incorrect sizes may provide insufficient bolt preload over time.

7 TORQUE TOLERANCES

The more accurate the method of controlling tightness the more of the strength of the fastener can be utilized. The tolerance values specified in this standard pertain to the tool's accuracy and not the induced fastener's load that is affected by other variables such as lubrication, clamped materials, temperature, etc. For example, assembly torque wrenches should be calibrated to stay within +/-4% when applying HGT-50, 80 or 35 and the fastener's induced load accuracy can be expected to range from +/- 10-20%.

8 LINK TO HS DOCUMENTS

HS 207 - Approved Hydraulic Fluids: Use products shown in table 1.

HS 609 - Lubricants and coolants: Use products shown in tables 1, 2 or 3 based on applications.

HS 897 - Adhesives: Use products shown in table 2 for soft joint applications.

9 HGT-80 STANDARD (SCREWS AND THREADED RODS - 80% PRELOAD)

The following torques must be applied to screws in order to produce the desired 80% preload.

Table 2 – HGT-80 Metric Fasteners

Grade 12.9 Fasteners Socket Head Cap Screw* (DIN912) Durlock Hex Head Cap Screw (UNB 12.9) Threaded Rod (DIN976)			
Size	Torque (+/- 4%)		Induced Screw Load (N)
	N-m	ft-lb	
M4	4.6	3.4	6800
M5	9.5	7.1	11000
M6	16	12	15600
M8	39	29	28400
M10	77	57	45000
M12	135	100	65000
M14	215	160	90000
M16	330	245	122000
M20	650	480	190000
M24	1100	810	273000
M30	2250	1660	435000
M36	3850	2840	634000
M42	6270	4630	870000
M48	8560	6320	1140000

Table 3 – HGT-80 Imperial Fasteners

ASTM A574 Fasteners Imperial Socket Head Cap Screw			
Size	Torque (+/- 4%)		Induced Screw Load (N)
	N-m	ft-lb	
#8	5	4	7000
#10	7	5	8700
1/4	16	12	15800
5/16	35	25	26100
3/8**	60	45	38000
7/16**	95	70	53000
1/2	150	110	71000
5/8	290	210	108000
3/4**	500	360	160000
7/8	790	580	222000
1	1180	865	291000
1 1/8	1680	1240	367000
1 1/4	2400	1750	466000
1 3/8	3100	2300	555000
1 1/2	4100	3040	676000
1 3/4	6500	4800	911000

* Referred to as “Husky Classes 1, 2, 3, and 4” in HS 258.

** When maintenance or service requires the replacement of screws, it is recommended that they be the same ones specified in the machine Bill of Material. Due to the interchangeability between some metric and imperial screws, incorrect sizes may provide insufficient bolt preload over time.

10 HGT-50 STANDARD (SCREWS AND THREADED RODS - 50% PRELOAD)

The following torques must be applied to screws in order to produce the desired 50% preload.

Table 4 – HGT-50 Metric Fasteners

Grade 12.9 and 10.9 Fasteners Socket Head Cap Screw* (DIN912) Hex Head Cap Screw (UNB 12.9, DIN933, DIN931) Threaded Rod (DIN976)			
Size	Torque (+/- 4%)		Induced Screw Load (N)
	N-m	ft-lb	
M4	3	2.2	4250
M5	6.2	4.6	8900
M6	10	7	9800
M8	25	18	17800
M10	53	40	31500
M12	95	70	47000
M14	130	95	56000
M16	220	160	85000
M18**	270	200	93000
M20	390	290	124000
M24	660	490	171000
M30	1300	960	272000
M36	2300	1700	396000
M42	3700	2700	544000
M48	5500	4000	714000

Table 5 – HGT-50 Imperial Fasteners

ASTM A574 Fasteners Imperial Socket Head Cap Screw			
Size	Torque (+/- 4%)		Induced Screw Load (N)
	N-m	ft-lb	
#8	3	2	4360
#10	4	3	5450
1/4	11	8	9900
5/16	22	16	16300
3/8**	40	30	24000
7/16**	60	45	33000
1/2	95	70	44000
5/8	180	135	68000
3/4**	310	230	100000
7/8	490	360	139000
1	750	550	182000
1 1/8	1040	770	230000
1 1/4	1480	1090	291000
1 3/8	1940	1430	347000
1 1/2	2580	1900	423000
1 3/4	4050	2990	570000

* Referred to as “Husky Classes 1, 2, 3, and 4” in HS 258.

** When maintenance or service requires the replacement of screws, it is recommended that they be the same ones specified in the machine Bill of Material. Due to the interchangeability between some metric and imperial screws, incorrect sizes may provide insufficient bolt preload over time.

11 HGT-35 STANDARD (SCREWS - 35% PRELOAD)

The following torques must be applied to screws in order to produce the desired 35% preload.

Table 6 – HGT-35 Metric Fasteners

Grade 12.9, 10.9 and A2 Fasteners Socket Head Cap Screw* (DIN912) Socket Head Cap Screw*** (Stainless Steel, A2) Hex Head Cap Screw (UNB 12.9, DIN933, DIN931) Flat Head Cap Screw (DIN7991) Button Head Cap Screw (ISO7380)			
Size	Torque (+/- 4%)		Induced Screw Load (N)
	N-m	ft-lb	
M4	2.1	1.5	2980
M5	4	3	4800
M6	9	7	7800
M8	19	14	14200
M10	37	27	22000
M12	50	37	24500
M16	125	90	49000
M20	250	185	79000
M24	440	325	115000
M30	875	650	182000
M36	1530	1130	265000

Table 7 – HGT-35 Imperial Fasteners

ASTM A574 Fasteners Imperial Socket Head Cap Screw			
Size	Torque (+/- 4%)		Induced Screw Load (N)
	N-m	ft-lb	
#8	1	1	2670
#10	3	2	3100
1/4	7	5	5800
5/16	14	10	9800
3/8**	23	17	14200
7/16**	38	28	20000
1/2	58	42	26700
5/8	110	81	41000
3/4**	180	135	60000
7/8	300	220	83000
1	450	330	111000
1 1/8	620	460	138000
1 1/4	890	660	175000
1 3/8	1170	860	208000
1 1/2	1550	1140	254000
1 3/4	2450	1790	342000

* Referred to as “Husky Classes 1, 2, 3, and 4” in HS 258.

** When maintenance or service requires the replacement of screws, it is recommended that they be the same ones specified in the machine Bill of Material. Due to the interchangeability between some metric and imperial screws, incorrect sizes may provide insufficient bolt preload over time.

*** HGT-35 is the proper torque for stainless steel screws (strength of stainless steel screw is 70% of grade 10.9).

12 HGT-SS STANDARD (SET SCREWS)

The following torques must be applied to set screws.

Table 8 – HGT-SS Metric Set Screws

ISO 898/5-45H Set Screws Metric Socket Set Screw (DIN913-14-15-16)		
Size	Torque (+/- 4%)	
	N-m	ft-lb
M3	0.9	0.66
M4	2.2	1.6
M5	4	3
M6	7.2	5.3
M8	17	12.6
M10	33	24
M12	54	40
M16	134	99
M20	237	175
M24	440	325

Table 9 – HGT-SS Imperial Screws

ASTM F912 Set Screws Imperial Socket Set Screw ANSI B18.3.1)		
Size	Torque (+/- 4%)	
	N-m	ft-lb
#5	1.1	0.8
#6	1.1	0.8
#8	2.7	2
#10	4	3
1/4	9.5	7
5/16	19	14
3/8	33	24
1/2	70	52
9/16	70	52
5/8	150	110
3/4	270	200
7/8	410	300
1	570	420

13 HGT-LHCS STANDARD (LOW HEAD CAP SCREWS)

The following torques must be applied to low head cap screws.

Table 10 – HGT-LHCS Metric Low Head Cap Screws

Grade 10.9 Low Head Cap Screws Low Head Cap Screws (DIN 7984)		
Size	Torque (+/- 4%)	
	N-m	in-lb
M4	2.7	24
M5	5.4	48
M6	9.15	81
M8	22	195
M10	44	389
M12	77	682
M16	190	1681
M20	371	3284

14 HGT-FT STANDARD (FITTINGS)

The following tables provide the recommended torque values required for the safe and effective operation of the fittings using a torque wrench or other methods such as “Turn From Finger Tight”, “Flats From Finger Tight” or “Flats from Wrench Resistance”. For TFFT or FFFT, the joint should be hand tightened snugly and then tightened with a wrench by the number of flats or turns indicated by the table. For “FFWR”, the joint should be tightened snugly with a wrench and then tightened again with the same wrench by the number of flats indicated by the table. The torque method of assembly is the preferred method of assembly. It reduces the risk of human error during assembly that is more prevalent in the “FFWR” method. To ensure the most accurate assembly of the fitting, it is strongly recommended that the torque method be utilized.

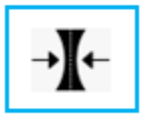
14.1 IMPORTANT NOTES

- O-rings must always be lubricated.
- Refer to the notes in red and the following symbols to determine if lubricant should be applied to threads.

Apply lubricant to threads

Do not apply lubricant to threads

- Values are for steel fittings in steel ports.
- For stainless steel fittings, please use the upper limit of torque range. Exclusion: NPT and BSPT fittings.
- For fittings made of softer metals such as brass or aluminum, decrease the torque values by 35% or use the reduced values shown under the following symbol. Exclusion: NPT and BSPT fittings.



Reduced values for brass or other soft metal fittings

- For NPT and BSPT elbows, never back off to achieve alignment.
- For ferrule (bite) fittings, manually screw the nut on the fitting body until finger tight. Continue to tighten the joint with a wrench by the number of flats indicated in the table. If the fitting body was used for ferrule pre-set, the nut must be re-tightened to the same fitting body used earlier in pre-set.
- Assembled parts (nut and adapter) must have identical plating.
- Torque values shown apply to the ends indicated by arrows.

Table 11 – HGT-FT ORFS Tube Ends

Steel Fittings - O-ring Face Seal Tube Ends

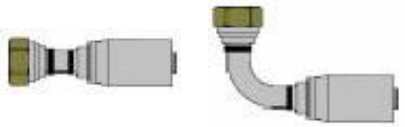
SAE Dash Size	Thread Size Inch	Tube Side Torque * (+10% - 0) Nm (ft-lb)	FFWR Tube Nuts (min-max)	FFWR Swivel & Hose Ends (min-max)	Reduced values for brass or other soft metal fittings ** (+10% - 0) Nm (ft-lb)
-4	9/16 - 18	25 (18)	1/4 - 1/2	1/2 - 3/4	16 (12)
-6	11/16 - 16	40 (30)	1/4 - 1/2	1/2 - 3/4	26 (20)
-8	13/16 - 16	55 (40)	1/4 - 1/2	1/2 - 3/4	36 (26)
-10	1 -14	80 (60)	1/4 - 1/2	1/2 - 3/4	52 (39)
-12	1-3/16 - 12	115 (85)	1/4 - 1/2	1/3 - 1/2	75 (55)
-16	1-7/16 - 12	150 (110)	1/4 - 1/2	1/3 - 1/2	98 (72)
-20	1-11/16 - 12	205 (150)	1/4 - 1/2	1/3 - 1/2	133 (98)
-24	2 - 12	315 (230)	1/4 - 1/2	1/3 - 1/2	205 (150)
-32	2 1/2 -12	510 (375)	1/4 - 1/2	1/3 - 1/2	332 (244)

*** IMPORTANT: Recommended torques values are only applicable for nut tightening in dry conditions (no oil or lubrication on threads and sealing surfaces, only O-rings must be lubricated).**

**** FFWR does not change**

Table 12 – HGT-FT ORFS Hose Ends (Manuli Hose Fittings)

Steel Fittings - O-ring Face Seal



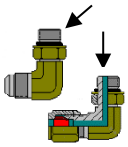
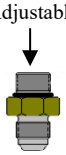
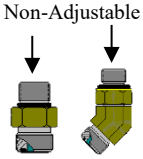
SAE Dash Size	Hose ID	Thread Size	Recommended Torque *		Rotation Angle (degrees)	FFFT Hose Ends
			Nm (0, +10%)	ft-lbs (0, +10%)		
-4	1/4"	9/16"-18	26	19	45°	3/4
-6	3/8"	11/16"-16	42	31	45°	3/4
-8	1/2"	13/16"-16	57	42	60°	3/4
-10	5/8”	1"-14	85	63	45°	1
-12	3/4"	1 3/16"-12	122	90	45°	3/4
-16	1"	1 7/16"-12	156	115	45°	3/4
-20	1 1/4"	1 11/16"-12	200	148	45°	3/4
-24	1 1/2"	2"-12	256	189	45°	3/4

Reduced values for brass or other soft metal fittings

Nm	ft-lbs
17	12
27	20
37	27
55	41
79	59
101	75
130	96
166	123

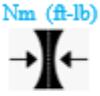
*** IMPORTANT: Recommended torques values are only applicable for nut tightening in dry conditions (no oil or lubrication on threads and sealing surfaces, only O-rings must be lubricated).**

Table 13 – HGT-FT SAE and BSPP Ends

Steel Fittings - Adjustable and Non-Adjustable SAE and BSPP Ends (Plugs excluded)				
SAE Dash Size	Thread Size Inch	Torque * (+10% - 0)		
		JIC, Ferrule Fittings	JIC, Ferrule & Pipe Fittings	Face Seal Fittings
		Adjustable 	Non-Adjustable 	Adjustable and Non-Adjustable 
		Nm (ft-lb)	Nm (ft-lb)	Nm (ft-lb)
-4	7/16 - 20	20 (15)	29 (15)	20 (15)
-6	9/16 - 18	40 (30)	40 (30)	46 (35)
-8	3/4 - 16	70 (52)	70 (52)	80 (60)
-10	7/8 - 14	115 (85)	115 (85)	135 (100)
-12	1-1/16 - 12	185 (135)	185 (135)	185 (135)
-14	1-3/16 - 12	235 (175)	235 (175)	235 (175)
-16	1-5/16 - 12	270 (200)	270 (200)	270 (200)
-20	1-5/8 - 12	340 (250)	340 (250)	340 (250)
-24	1-7/8 - 12	415 (305)	415 (305)	415 (305)
-32	2-1/2 - 12	510 (375)	510 (375)	510 (375)

*** IMPORTANT: Lubricate threads before assembly.**

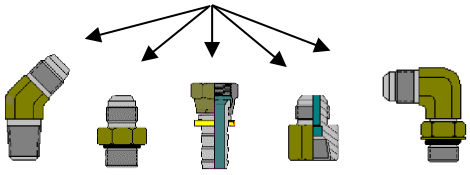
Reduced values for brass or other soft metal fittings Nm (ft-lb)



JIC, Ferrule Fittings	JIC, Ferrule & Pipe Fittings	Face Seal Fittings
13 (10)	19 (10)	13 (10)
26 (20)	26 (20)	30 (23)
46 (34)	46 (34)	52 (39)
75 (55)	75 (55)	88 (65)
120 (88)	120 (88)	120 (88)
153 (114)	153 (114)	153 (114)
176 (130)	176 (130)	176 (130)
221 (163)	221 (163)	221 (163)
270 (198)	270 (198)	270 (198)
332 (244)	332 (244)	332 (244)

Table 14 – HGT-FT JIC Ends

Steel Fittings - JIC (37 Deg Flared Tube) Ends



SAE Dash Size	Thread Size Inch	Assembly Torque * (+10% - 0) Nm (ft-lb)	Tube End FFWR	Hose End or Swivel Nut FFWR
4	7/16 - 20	18 (13)	2 1/2	2
6	9/16 - 18	30 (22)	2	1 1/2
8	3/4 - 16	57 (42)	2	1 1/2
10	7/8 - 14	81 (60)	1 1/2	1 1/2
12	1-1/16 - 12	115 (84)	1 1/2	1 1/4
14	1-3/16 - 12	135 (100)	1 1/2	1 1/4
16	1-5/16 - 12	160 (118)	1 1/2	1
20	1-5/8 - 12	230 (168)	1	1
24	1-7/8 - 12	265 (195)	1	1
32	2-1/2 - 12	360 (265)	1	1
40	3-12	Not Applicable	1	1

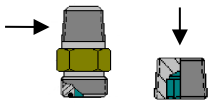
*** IMPORTANT: Torque values are for unlubricated carbon steel components and properly lubricated stainless-steel components.**

Reduced values for brass or other soft metal fittings ** Nm (ft-lb)

12 (8)
20 (14)
37 (27)
53 (39)
75 (55)
88 (65)
104 (77)
150 (109)
172 (127)
234 (172)
Not Applicable

**** FFWR does not change**

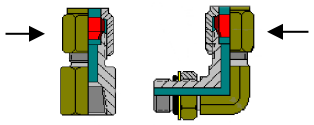
Table 15 – HGT-FT NPT and BSPT Plugs and Fittings

Steel NPT and BSPT Fittings and Plugs		
Torque * 		
NPTF Inch	BSPT Inch	TFFT (min-max)
1/8-27	1/8-28	2 - 3
1/4-18	1/4-19	2 - 3
3/8-18	3/8-19	2 - 3
1/2-14	1/2-14	2 - 3
3/4-14	3/4-14	2 - 3
1 - 11-1/2	1 – 11	1.5 - 2.5
1-1/4 - 11-1/2	1-1/4 - 11	1.5 - 2.5
1-1/2 - 11-1/2	1-1/2 - 11	1.5 - 2.5
2 - 11-1/2	2 - 11	1.5 - 2.5

*** IMPORTANT: Carbon & stainless steel components: Apply lubricant to male pipe threads if not pre-applied. The first to two threads should be left uncovered to avoid system contamination.**

For brass or other soft metal NPT and BSPT fittings, **TFFT does not change**

Table 16 – HGT-FT Flareless Tube Ends

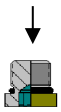
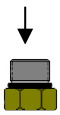
Steel Ferrule (Bite) Fittings		
Torque * 		
SAE Dash Size	Thread Size Inch	Nut TFFT (min-max)
4	7/16 - 20	1/6 - 1/4
6	9/16 - 18	1/6 - 1/4
8	3/4 - 16	1/6 - 1/4
10	7/8 - 14	1/6 - 1/4
12	1-1/16 - 12	1/6 - 1/4
14	1-3/16 - 12	1/6 - 1/4
16	1-5/16 - 12	1/6 - 1/4
20	1-5/8 - 12	1/6 - 1/4
24	1-7/8 - 12	1/6 - 1/4
32	2-1/2 - 12	1/6 - 1/4

*** IMPORTANT: Carbon steel components: Lubricate threads before assembly. No additional lubrication is required for stainless steel fittings as the nuts are pre-lubricated.**

Note: For final assembly of swivel nut fittings (R6BU, C6BU and S6BU), a 3/4 TFFT is required for all sizes.

For brass or other soft metal bite fittings, **TFFT does not change**

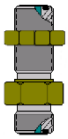
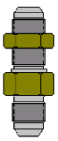
Table 17 – HGT-FT SAE Plugs

Steel Fittings - SAE Straight Thread Plugs			
SAE Dash Size	Thread Size	Torque * (+10% - 0)	
		Hollow Hex Plug 	Hex Plug 
	Inch	Nm (ft-lb)	Nm (ft-lb)
-2	5/16 - 24	7 (5.2)	10 (7.4)
-3	3/8 - 24	11 (8.1)	18 (13)
-4	7/16 - 20	20 (14.8)	29 (21)
-5	1/2 – 20	28 (20.7)	32 (23)
-6	9/16 - 18	40 (30)	40 (30)
-8	3/4 - 16	70 (52)	70 (52)
-10	7/8 - 14	115 (85)	115 (85)
-12	1-1/16 - 12	185 (135)	185 (135)
-14	1-3/16 - 12	235 (175)	235 (175)
16	1-5/16 - 12	270 (200)	270 (200)
-20	1-5/8 - 12	340 (250)	340 (250)
-24	1-7/8 - 12	415 (305)	415 (305)
-32	2-1/2 - 12	510 (375)	510 (375)

*** IMPORTANT: Lubricate threads before assembly.**

Reduced values for brass or other soft metal plugs Nm (ft-lb) 	
Hollow Hex Plug	Hex Plug
4.5 (3.4)	6.5 (4.8)
7.2 (5.3)	11.7 (8.4)
13 (9.6)	19 (14)
18 (13.5)	21 (15)
26 (20)	26 (20)
46 (34)	46 (34)
75 (55)	75 (55)
120 (88)	120 (88)
153 (114)	153 (114)
176 (130)	176 (130)
221 (163)	221 (163)
270 (198)	270 (198)
332 (244)	332 (244)

Table 18 – HGT-FT Bulkhead Locknuts

Steel Fittings - Bulkhead Locknuts		
SAE Dash Size	Torque * (+10% - 0)	
	O-ring Face Seal Ends 	JIC or ferrule Ends 
	Nm (ft-lb)	Nm (ft-lb)
4	20 (15)	18 (13)
6	34 (25)	35 (25)
8	75 (55)	65 (50)
10	115 (75)	115 (85)
12	180 (125)	180 (135)
14	230 (170)	230 (170)
16	270 (200)	270 (200)
20	330 (245)	330 (245)
24	365 (270)	365 (270)
32	Not Applicable	420 (310)

*** IMPORTANT: Torque values are only applicable for nut tightening in dry conditions**

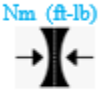
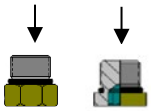
Reduced values for brass or other soft metal fittings Nm (ft-lb) 	
O-ring Face Seal Ends	JIC or ferrule Ends
13 (10)	12 (13)
22 (16)	23 (25)
49 (36)	42 (50)
75 (49)	75 (49)
117 (81)	117 (81)
150 (111)	150 (111)
176 (130)	176 (130)
215 (159)	215 (159)
237 (176)	237 (176)
Not Applicable	273 (202)

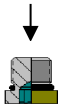
Table 19 – HGT-FT BSPP Plugs

Steel Fittings - BSPP Plugs (Hex and Hollow Hex)	
Thread Size	Torque * (+10% - 0) 
Inch	Nm (ft-lb)
1/8 - 28	13 (9.6)
1/4 - 19	30 (22)
3/8 - 19	60 (44)
1/2 - 14	80 (60)
3/4 - 14	140 (105)
1 - 11	200 (155)
1-1/4 - 11	400 (295)
1-1/2 - 11	450 (330)

* IMPORTANT: Lubricate threads before assembly 

Reduced values for brass or other soft metal plugs Nm (ft-lb) 
8.5 (6.2)
20 (14)
39 (29)
52 (39)
91 (68)
130 (101)
260 (192)
293 (215)

Table 20 – HGT-FT Metric Plugs

Steel Fittings - Metric Plugs	
Thread Size	Torque * (+10% - 0) 
Metric	Nm (ft-lb)
M42	400 (295)
M48	500 (370)
M52	600 (440)
M60	800 (590)
M64	850 (630)
M68	1000 (740)
M70	1100 (810)
M75	1300 (960)
M80	1550 (1150)
M85	1800 (1330)
M90	2000 (1480)

* IMPORTANT: Lubricate threads before assembly 

Reduced values for brass or other soft metal plugs Nm (ft-lb) 
260 (192)
325 (241)
390 (286)
520 (384)
553 (410)
650 (481)
715 (527)
845 (624)
1008 (748)
1170 (865)
1300 (962)

15 HGT-EL STANDARD (ELECTRICAL APPLICATIONS)

The following torque values should be used in the case of electrical applications. Notes: For non-standard components, use the recommended manufacturer's specifications. For DLO (Diesel Locomotive Cable) related connections, please call Husky Service or refer to section 20.1 - DLO Device Details.

Table 21 – HGT-EL Metric and Imperial Screws, Mounting Hardware (Electrical Applications)

Metric and Imperial Screws				
Size		Torque Nm (in-lb) (+10% - 0)		
		Steel	Al & Cu	Brass
M3	**#4**	0.7 (6.2)	0.3 (2.6)	0.6 (5.3)
M3.5	**#6**	1 (8.8)	0.5 (4.4)	0.8 (7.1)
M4	**#8**	1.3 (11.5)	0.7 (6.2)	1.2 (10.6)
M5	**#10**	1.9 (16.8)	1 (8.8)	1.7 (15.0)
M6	**1/4**	6 (53.1)	3 (26.5)	5 (44.2)
M8	**5/16**	8 (70.8)	4 (35.4)	5 (44.2)
M10	**3/8**	10 (88.5)	5 (44.2)	8 (70.8)

Table 22 – HGT-EL Heater Bands (Electrical Applications)

Heater Band Fasteners				
Fastener Size	Fastener Type			
	Nickel or Zinc Plated Dry	**Nickel or Zinc Plated Anti-Seize**	**Black Oxide Dry**	**Black Oxide Anti-Seize**
UNC # 6 - 32	30 lb-in / 3.4 N-m	20 lb-in / 2.3 N-m	20 lb-in / 2.3 N-m	15 lb-in / 1.7 N-m
UNC # 8 - 32	40 lb-in / 4.5 N-m	30 lb-in / 3.4 N-m	25 lb-in / 2.8 N-m	20 lb-in / 2.3 N-m
UNC # 10 - 24	55 lb-in / 6.2 N-m	35 lb-in / 4.0 N-m	35 lb-in / 4.0 N-m	30 lb-in / 3.4 N-m
UNC # 1/4 - 20	80 lb-in / 9.0 N-m	55 lb-in / 6.2 N-m	50 lb-in / 5.6 N-m	45 lb-in / 5.1 N-m
UNC # 1/4 - 20 Barrel Bar Clamp* and Spider Straps	80 lb-in / 9.0 N-m	80 lb-in / 9.0 N-m	80 lb-in / 9.0 N-m	80 lb-in / 9.0 N-m
UNC # 5/16 - 18	80 lb-in / 9.0 N-m	80 lb-in / 9.0 N-m	80 lb-in / 9.0 N-m	80 lb-in / 9.0 N-m
M6***	80 lb-in / 9.0 N-m	55 lb-in / 6.2 N-m	N/A	N/A

Heater Band Ground Stud Nut **	18 lb-in / 2.0 N-m maximum
Post Terminal Nut **	24 lb-in / 2.7 N-m maximum

* For screws attached to each other through a 'common' barrel bar clamp

** Use an open ended wrench to hold the nut closest to the heater as the wiring nut is torqued (threaded ground stud must not rotate).

*** For heater bands with corrugated sheet metal on outside diameter

Table 23 – HGT-EL Solid State Relays (Electrical Applications)

Solid state relays (e.g. HPN 231452, Crydom model# H12D4840DE 40A Dual SSR)	15 to 20 lb-in / 1.7 to 2.2 N-m

Table 24 – HGT-EL Premolded Cables (Electrical Applications)

Premolded Cable Size	Torque
M8	3.5 lb-in / 0.4 N-m
M12	5.5 lb-in / 0.6 N-m

Table 25 – HGT-EL Electrical Cabinet Door Ground Stud (Electrical Applications)

M6	35 lb-in / 4.0 N-m

16 DRAWING SPECIFICATIONS

- All fasteners and fittings requiring a torque value that deviates from the HGT standards or special torque specifications displayed in section 17 must be individually specified on the drawing next to the item reference (balloon or arrow on the assembly drawing as shown in Figure 3).
- A note referring to the torque standard (HS 252) will be inscribed in the title block of the assembly drawing (see in Figure 4).

Figure 3 – Individual Torque Specifications

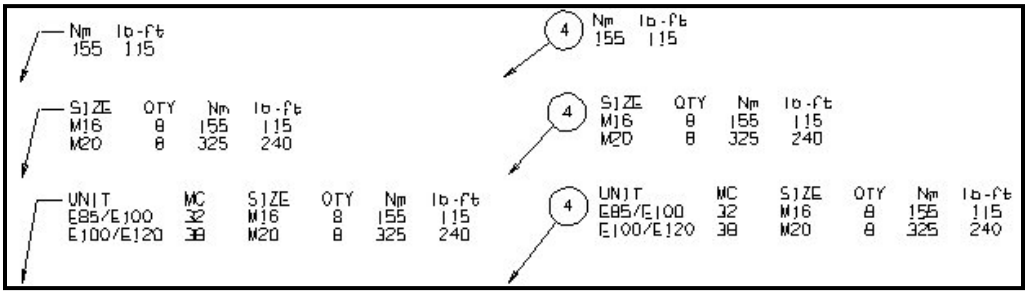
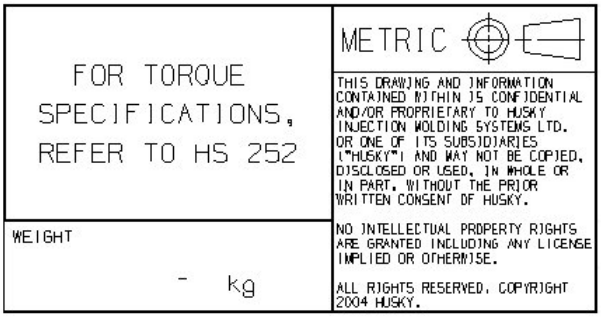


Figure 4 – Husky General Torque Chart



17 SUPPLIER RECOMMENDED TORQUE SPECIFICATIONS

The following torque values are recommended by suppliers and must be followed unless otherwise specified on the drawing.

17.1 HYDRAULIC MANIFOLDS – TORQUE VALUES FOR SCREWS

Table 26 – Torque for Hydraulic Valves Mounting Bolts

Torque N-m (ft-lb) Min.-Max.										
Bolt Size	**Bosh**			**Rexroth**			**Moog/Hydrolux**			**Hyd. Option Segment Manifold**
	Prop. Valves	**Direct Valves**	**Cartridges**	**Prop. Valves**	**Direct Valves**	**Cartridges**	**Prop. Valves**	**Direct Valves**	**Cartridges**	
M5	6-8 (4.4-5.9)	6-8 (4.4-5.9)		6.2-8.9 (4.6-6.6)	6.2-8.9 (4.6-6.6)		5.8-7.8 (4.2-5.7)	7.2-8 (5.3-5.9)		8.9-9.8 (6.6-7.2)
M6	11-14 (8.1-10.3)	11-14 (8.1-10.3)		11-15.5 (8.1-11.4)	11-15.5 (8.1-11.4)		9.4-12.6 (6.9-9.3)	11.7-13 (8.6-9.6)		15.5-17 (11.5-12.6)
M8			26-31 (19-23)			23-32 (17-23)			27-30 (20-22)	32-35 (23-26)
M10	40-50 (30-37)	50-60 (37-44)		53-75 (39-55)	53-75 (39-55)		46-62 (34-45)	50-55 (37-40)		75-83 (55-61)
M12	90-120 (66-88)	85-100 (63-73)	90-105 (66-77)	91-130 (67-96)	91-130 (67-96)	77-110 (57-81)	80-108 (59-80)	90-100 (66-74)	90-100 (66-74)	110-121 (81-89)
M16			240-260 (178-192)			189-270 (139-199)			270-300 (199-221)	270-297 (200-219)
M20	450-560 (332-410)		450-500 (332-369)	301-430 (222-317)	301-430 (222-317)	364-520 (268-383)	391-529 (288-390)	495-550 (365-406)	495-550 (365-405)	520-572 (385-422)
M24						630-900 (464-664)			810-900 (598-664)	900-990 (665-730)
M30						1260-1800 (929-1327)			1620-1800 (1195-1328)	1800-1980 (1330-1460)
Lubricant	Hydraulic Oil									Grease

Note: Those values are mandatory, regardless of screw quality used.

17.2 HYDRAULIC MANIFOLDS – TORQUE VALUES FOR ORIFICES

Table 27 – Torque for Orifices on Hydraulic Manifolds

Hydraulic Manifolds – Orifices		
Bolt Size	Torque (+/- 4%)	
	N-m	ft-lb
M5	4	3
M6	6	4.5
M8	13.5	10
M10	27	20
M12	47	35
M16	110	80
M20	195	145
M24	330	245
M30	650	480
Lubricant	Grease	

17.3 HOSE/PIPE CLAMPS – TORQUE VALUES FOR SCREWS

Table 28 – Torque for Stauff or Hydac Hose/Pipe Clamps Mounting Bolts

Clamp Type	Lubricant	Bolt Size	Clamp Size	Torque in Nm (ft-lb) (+/- 4%) with Clamping Material		
				Aluminum (AL)	Polypropylene (PP)	Polyamid (PA)
Single clamp Light series	Loctite	M6	0 to 6	12 (9)	8 (5.9)	10 (7.4)
Single clamp Heavy series		M10	1	30 (22)	12 (9)	20 (15)
			2	30 (22)	12 (9)	20 (15)
			3	35 (26)	15 (11)	25 (18)
		M12	4	55 (40)	30 (22)	40 (30)
		M16	5	120 (90)	45 (33)	55 (40)
		M20	6	220 (160)	80 (60)	150 (110)
		M24	7	250 (180)	110 (80)	250 (180)
Twin clamp		M6	1	N/A	5 (3.7)	6 (4.4)
		M8	2	N/A	12 (8.9)	12 (8.9)
			3	N/A		
			4	N/A		
			5	N/A	8 (5.9)	8 (5.9)

Table 29 – Torque for Stopflex Hose Bands Mounting Bolts

Stopflex Hose Bands

Hose Band	Hose Outside Diameter (mm)		Bolt Size (metric)	Bolt Tightening Torque
Model Number	Ø MIN	Ø MAX	Ø M	Nm (ft-lb) (+/- 4%)
STOPFA13135	13	13.5	M6	3 (2)
STOPFA1415	14	15	M6	3 (2)
STOPFA1718	17	18	M6	3 (2)
STOPFA1819	18	19	M6	3 (2)
STOPFA2122	21	22	M6	3 (2)
STOPFA3031	30	31	M6	7 (5)
STOPFA3233	32	33	M6	7 (5)
STOPFA3839	38	39	M6	7 (5)
STOPFA3940	39	40	M6	7 (5)
STOPFA4547	45	47	M8	10 (7)
STOPFA5354	53	54	M8	10 (7)
STOPFA5456	54	56	M8	10 (7)
STOPFA5759	57	59	M8	10 (7)
STOPFA6668	66	68	M8	10 (7)
STOPFA7274	72	74	M8	10 (7)

Table 30 – Heavy-Duty Hose Clamp (T-Bolt Style)

King Seal Fastener Technology Part # KTB425 (100-108mm) HPN 10534088	50-60 in-lb (5.6-6.8 N-m)	

Table 31 – Torque for Diffuser Hose Clamp

Mikalor Steel Clamp Part # MIK-149-161 (6"ID Duct) HPN 2981775	26 ft-lb (35.3 N-m)	

17.4 HYDRAULIC MOTORS – TORQUE FOR MOUNTING BOLTS

Table 32 – Torques for Hydraulic Motors Mounting Bolts

Torque N-m (ft-lb) +/-tolerance value	
Bolt Size	**Hagglungs Hydraulic Motors**
M16	280 +/-15 (205 +/-11)
M20	540 +/-20 (400 +/-15)
M24	900 +/- 30 (665 +/-22)
Lubricant	Hydraulic Oil

17.5 BOSCH REXROTH DBDS PRESSURE RELIEF VALVES

Table 33 – Bosh Rexroth DBDS Pressure Relief Valves

Size	**Maximum Tightening Torque * (+/- 5%)**	
NG	**N-m**	**ft-lb**
6	80	59
10	150	110
20	300	221
30	500	369

* The tightening torques are recommended values assuming a friction coefficient of 0.12 and the use of a torque wrench.

17.6 Bladder Accumulator Neck Adaptor Specifications

Table 34 – Bladder Accumulator Neck Adaptor Specifications

Accumulator Size	Accumulator Port Size	Torque [N-m]	Torque [ft-lb]
10L	BSPP 2” (G 2”)	339 N-m	250 ft-lb
20L	BSPP 2” (G 2”)	339 N-m	250 ft-lb
32L	BSPP 2” (G 2”)	339 N-m	250 ft-lb
50L/54L	BSPP 2” (G 2”)	339 N-m	250 ft-lb
50L High Flow	BSPP 2 ½” (G 2 ½”)	420 N-m	310 ft-lb

17.7 Hydac Oil Level Sight Gauge

HPN 2841146 (Hydac Model # 3070285 FSK127-2.5/0/-/12) HPN 7604852 (Hydac Model # 3532906 FSKV-176-1.0/W/-/12 2SP)	M12 banjo bolts	Lubricated bolt: 6 N-m (+0.5, 0) 4.4 ft-lb (+0.4, 0) Dry bolt: 8 N-m (0, -0.5) 5.9 ft-lb (, -0.4)

17.8 Hydac Pressure Transducers

HPN 7980938 (Hydac Model # 926910 Pressure transmitter HDA 4776-A-300-453)	40 N-m (+10%, -0)	30 ft-lb (+10%, -0)
HPN 9247632 (Hydac Model # 927321 Pressure transmitter HPT 1776-A-0300-453)	40 N-m (+10%, -0)	30 ft-lb (+10%, -0)

17.8.1 Hydac Differential Pressure Transmitter

HPN 6404099 (Hydac PN # 924030 Differential Pressure Transmitter HDT 5416-C-05.0-S-000, G1/2	100 N-m (+10%, -0)	74 ft-lb (+10%, -0)

17.9 Danfoss Pressure Transducer

HPN 6830141 Danfoss Part # 063G2021, MBS 1250, 300 bar	M12x1	33 ft-lb (45 N-m) (+10%, -0)

17.10 NUMATICS AIR VALVE ASSEMBLY TORQUE SPECIFICATIONS

The following torque specifications are recommended by the supplier and should be used unless otherwise specified. These specifications apply to Numatics 2012, 2035, ISO 1, ISO 2 & ISO 3 air valve assemblies.

17.10.1 TORQUE SPECIFICATIONS FOR NUMATICS 2012 & 2035 AIR VALVE ASSEMBLIES

Figure 5 – Numatics 2012 & 2035 Air Valve Assemblies

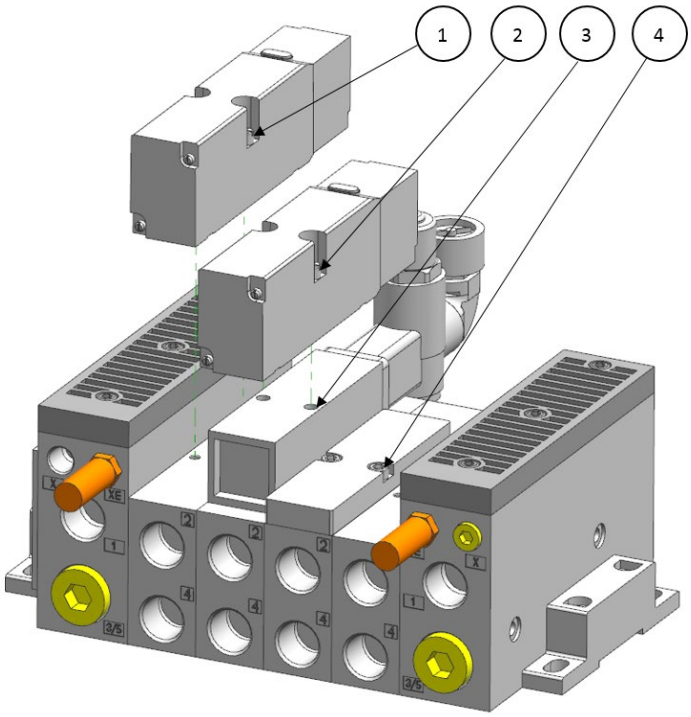


Table 35 – Numatics 2012 & 2035 Air Valve Assemblies

Fastener	Description	2012 Air Valve Assy		2035 Air Valve Assy	
		Torque		Torque	
		N-m	in-lb	N-m	in-lb
1	Valve to Manifold	0.9-1.1	8-10	2.5-2.8	22-25
2	Valve to Sandwich Plate	0.9-1.1	8-10	2.8-3.4	25-30
3	Sandwich Plate to Manifold	0.9-1.1	8-10	2.8-3.4	25-30
4	Blanking Plate to Manifold	1.4-1.7	12-15	2.8-3.4	25-30

17.10.2 TORQUE SPECIFICATIONS FOR NUMATICS ISO 1, 2 & 3 AIR VALVE ASSEMBLIES

Figure 6 – Numatics ISO 1, 2 & 3 Air Valve Assemblies

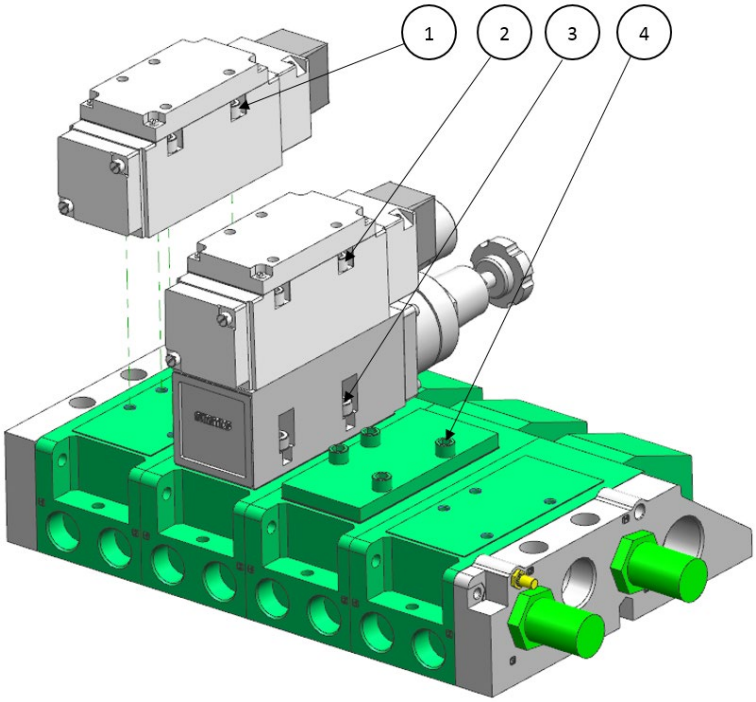


Table 36 – Numatics ISO 1, 2 & 3 Air Valve Assemblies

Fastener	Description	ISO 1, 2 & 3 Air Valve Assemblies	
		Torque	
		N-mm	in-lb
1	Valve to Manifold	3.6-4.3	32-38
2	Valve to Sandwich Plate	3.6-4.3	32-38
3	Sandwich Plate to Manifold	3.6-4.3	32-38
4	Blanking Plate to Manifold	3.6-4.3	32-38

17.11 HYDAC MALE PRESSURE TEST POINT

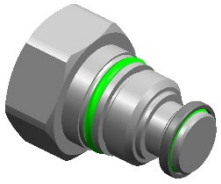
HPN 2638323 Hydac designation: 6003737 (9/16-18 UNF, 630 bar, 1620 series, O-ring/Form E)	Thread 9/16-18 UNF	25 ft-lb (35 N-m) (+10%, -0)

17.12 ACCUMULATOR GAS VALVES

HPN 9007755 Denergy designation: AV500-4000	22 ft-lb (30 N-m) (+10%, -0)	
HPN 11862074 Denergy designation: GV03-00	22 ft-lb (30 N-m) (+10%, -0)	

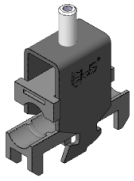
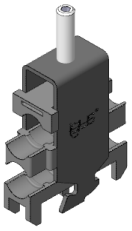
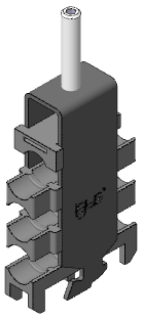
Note: Gas valves for standard accumulators, 4000psi

17.13 EV9 FLOW CONTROL VALVES

HPN 7610661 Sun Hydraulics designation: FXAAXAV 0.25 LPM (Liters Per Minute) HPN 13078474 Sun Hydraulics designation: FXAAXDN 0.66 LPM (Liters Per Minute)	25 ft-lb (34 N-m) (+10%, -0)	

Note: Fixed orifice, pressure compensated flow control valve, 5000psi

17.14 IGUS CFX CLAMPS

HPN	Model #		
741401	CFX12.1	1.1 ft-lb (1.5 N-m) (+10%, -0)	Single, double or triple clamp housings   
741403	CFX12.2		
2200645	CFX12.3		
741400	CFX14.1		
741402	CFX14.2		
2295429	CFX14.3		
2143391	CFX16.1		
2200643	CFXL16.1		
741570	CFX16.2		
2206628	CFX16.3		
745860	CFX18.1		
742126	CFX18.2		
741399	CFX20.1		
2240786	CFX20.2		
745859	CFX22.1		
741569	CFX22.2		
747804	CFX26.1		
742128	CFX30.1		
6837530	CFX30.2		
7577891	CFXL30.2		
3623334	CFX38.1		
746702	CFX42.1		

17.15 VIBRATION MOUNTS

Apply HGT-35 torque to all vibration mounts unless otherwise specified on assembly drawings or work instructions.

18 INTERNATIONAL STANDARDS TORQUE SPECIFICATIONS

The following torque values obtained from international standards are specified on the drawing when deviating from the Husky general torque standard.

18.1 ISO 6162:1994 - SPLIT FLANGE ASSEMBLIES

Table 37 – Code 61 Split Flange Assemblies

4 Bolt Split Flange Assemblies Code 61 (25 bar to 350 bar series)		
Bolt Size	Torque (+25% - 0) See Section 18.3	
	N-m	ft-lb
M8	25	18
M10	53	40
M12	95	70
M16	220	160
Lubricant	Lubriplate FGL-1 or Molykote G – rapid plus with MoS2	

Table 38 – Code 62 Split Flange Assemblies

4 Bolt Split Flange Assemblies Code 62 (400 bar series)		
Bolt Size	Torque (+25% - 0) See Section 18.3	
	N-m	ft-lb
M8	25	18
M10	53	40
M12	95	70
M14	150	110
M16	220	160
M20	390	290
Lubricant	Lubriplate FGL-1 or Molykote G – rapid plus with MoS2	

18.2 CAUTION

It is important that all screws be lightly torqued (e.g. from 1 to 2 FFFT) before applying the final recommended torque values to avoid breaking the flange halves during installation.

18.3 NOTES

- The recommended torque values are consistent with the HGT-50 general standard. Exception: M14 bolts (special size requiring a note on the drawing).
- The recommended torque values may be increased by 25% when flange head screws of property 12.9 screws are used with Unbrako Durlok-12.9 screws.

19 PET MOLD AND HOT RUNNER SPECIAL TORQUE SPECIFICATIONS

Following torque specifications must be applied accordingly to ensure proper installation.

19.1 CAM FOLLOWER TORQUE SPECIFICATIONS

Table 39 – CAM Follower Torque Specifications

CAM follower HPN	Component	Torque [N-m]	Torque [ft-lb]
1425388	Cam Follower	22 N-m	16 ft-lb
1502548	Cam Follower	87 N-m	64 ft-lb
	Set Screw	8.5-9 N-m	6.3-6.6 ft-lb
2739013	Cam Follower	87 N-m / 315 N-m **	64 ft-lb / 232 ft-lb **
	Set Screw	8.5-9 N-m	6.3-6.6 ft-lb
5792862	Cam Follower	87 N-m	64 ft-lb
	Set Screw	8.5-9 N-m	6.3-6.6 ft-lb

** Torque the cam follower to the higher torque only when there is no set screw installation in slide

19.2 EOAT TUBE RETAINER PIN TORQUE SPECIFICATION

Figure 7 – EOAT Tube Retainer Pin Torque Specification

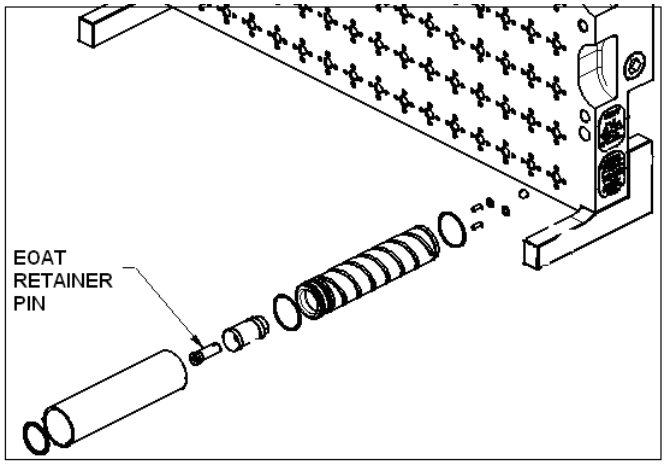


Table 40 – EOAT Tube Retainer Pin Torque Specification

Hex Size (mm)	Torque (N-m)	Torque (ft-lb)
5	37	27
4	20	15

19.3 COOLPIK VACUUM/BLOW PIN TORQUE SPECIFICATIONS

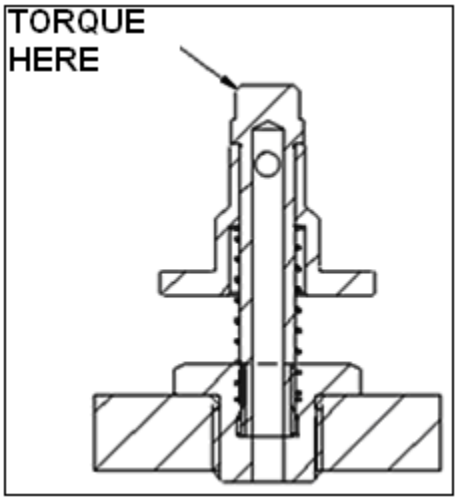
Table 41 – COOLPIK Vacuum/Blow Pin Torque Specifications

Vacuum/Blow Pin Size	Torque	
	N-m	ft-lb
M6	2	1.4
M12	15	11
M16	34	25
M20	60	44

19.4 COOLPIK MOVING PUCK INSTALLATION TORQUE SPECIFICATION

Apply following torque during moving puck installation.

Figure 8 – Moving Puck Assembly Installation Torque Specification

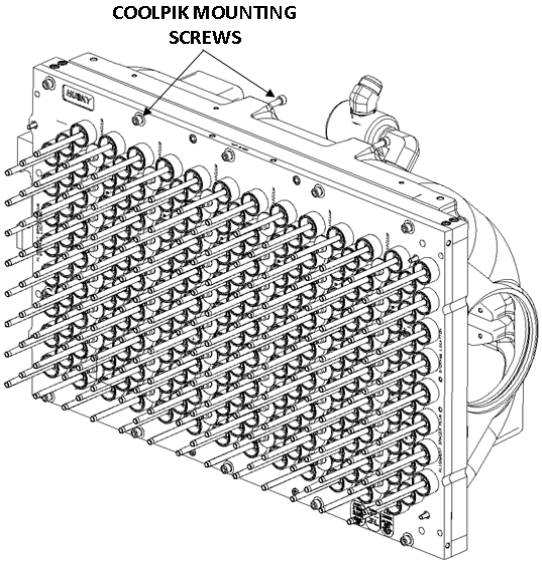


Torque the sub-assembly into the COOLPIK plate to 18 N-m through the top of the pin using an 8mm socket.

19.5 COOLPIK PLATE MOUNTING TORQUE SPECIFICATION

Apply HGT-80 [77N-m (56.8 lb-ft)] torque for M10 COOLPIK plate mounting screws.

Figure 9 – COOLPIK Assembly on Machine Plenum



19.6 MOLD/HOT RUNNER LIFT BARS MOUNTING SCREWS TORQUE APPLICATIONS

Table 42 – Mold/Hot Runner Lift Bars Mounting Screws Torque Specifications

Application		Hardware		Base/Threaded Material	Torque Standard
Mechanical	**• Hot Runner/Mold Lift Bars Mounting Screws (Excluding M30 and Larger Sizes)**	Screws and Threaded Rods	- DIN 912-12.9 SHCS - DURLOK-12.9-UNB HHS - DIN 933 & 931-10.9 HHCS - DIN 976-12.9&10.9 ROD - ASTM A574 SHCS	Steel Cast Iron	HGT-50
	• Hot Runner/Mold Lift Bars Mounting Screws, M30 and Larger Sizes	Screws and Threaded Rods	- DIN 912-12.9 SHCS - DURLOK-12.9-UNB HHS - DIN 933 & 931-10.9 HHCS - DIN 976-12.9&10.9 ROD - DIN 7991-10.9 FHCS - ISO 7380-10.9 BHCS - ASTM A574 SHCS	Any Material for Lift Bar Mounting Screws	HGT-35

19.7 GIB/WEAR PLATE MOUNTING SCREWS TORQUE SPECIFICATION

Apply HGT-50 on Gibs and Wear Plates.

Apply HGT-LHCS for Wear Plates using LHCS.

19.8 NECK RING PLUGS TORQUE SPECIFICATION

Apply appropriate torque to the Neck Ring plugs according to the table below.

Table 43 – Neck Ring Plugs Torque Specifications

HPN	Size	Material	Maximum Tightening Torque (+ 10% / - 10%)	
			N-m	ft-lb
4125714	M5	Brass	1.5	1.1
6359476	1/16	Brass	7	5.2

19.9 STACK INSERTS TORQUE SPECIFICATION

Apply HGT-80 on all SHCS's that are used on Stack Inserts.

19.10 TORQUE SPECIFICATION FOR WATER MANIFOLDS TO SLIDES

Apply HGT-80 on all SHCS's that are used to mount Slide Water Manifolds to Slides.

19.11 TORQUE SPECIFICATION FOR SLIDE TO CONNECTING BARS

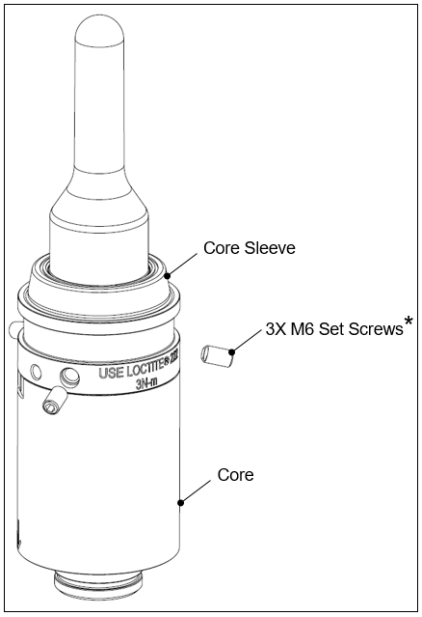
Apply HGT-80 on all SHCS's that are used to mount Slides to Connecting Bars.

19.12 TORQUE SPECIFICATION FOR EOAT ASSY. TO ROBOT

Apply HGT-80 on all SHCS's that are used to mount EOAT Assembly to Robot Carriage.

19.13 TORQUE SPECIFICATION FOR NEXPET CORE SLEEVE SET SCREWS

Figure 10 – Torque Specification for NexPET Core Sleeve Set Screws



*Apply LOCTITE® 222 or equivalent to the set screws and tighten them to 3N-m [2.2 lb-ft] – refer to NexPET mold manual for detailed installation instructions.

20 APPENDIX

20.1 DLO DEVICE DETAILS (2205)

Refer to the following sheets (See 6 to 17) for DLO device torque values.

3VA Breakers

BREAKERS		BREAKER LUGS			MOUNTING BOLTS		UNINSULATED FERRULES				FLEXIBLE BUSBAR				COMPRESSION LUGS / BUSBAR			
Type	SIZE (A)	Type	HPN	# of Conn.	Torque lb-in	Torque N-m	AWG	Strip (mm)	Torque AWG	Torque lb-in	Torque N-m	Max Width (mm)	Thickness (mm)	Torque lb-in	Torque N-m	Max W x D (mm)	Bolt Size	Torque lb-in	Torque N-m
3VA51	15-125	3VA9133-0JA11 3VA9134-0JA11	10915876 10973718	1	N/A		14 - 1/0	12	14 - 6 4 - 1/0	44 71	5 8	13	1 - 7.2	71	8	N/A			
		3VA9133-0JF60 3VA9134-0JF60	10915905 10973732	2 2 2	71	8	14 - 4	12 24 39	14 - 8 6 - 4	53 62	6 7	N/A							
		3VA9133-0QA00 3VA9134-0QA00	10915899 10973740	1	N/A		N/A					N/A				17 x 6.5	M6	71	8
		3VA9133-0QB00 3VA9134-0QB00	10915916 10973748	1	71	8	N/A					N/A				22 x 8	M6	71	8
3VA52	70-250	3VA9233-0JA11 3VA9234-0JA11	10943437 10973757	1	N/A		10 - 3/0	19	10 - 4 2 - 3/0	53 89	6 10	20	1 - 6	89	10	N/A			
		3VA9233-0JA12 3VA9234-0JA12	10943456 10973768	1	N/A		4 - 313	20	4 - 2 1 - 313	71 142	8 16	20	3.2 - 6	106	12				
		3VA9233-0JF60 3VA9234-0JF60	10915946 10973778	2 2 2	177	20	14 - 4	15 26 39	14 - 8 6 - 4	53 62	6 7	N/A							
		3VA9233-0JJ22 3VA9234-0JJ22	10915940 10973780	1 1	177	20	4 - 4/0	25 50	4 - 4/0	275	31								
		3VA9233-0QA00 3VA9234-0QA00	10915935 10973788	1	N/A		N/A					N/A				25 x 8	M8	177	20
		3VA9273-0QB00 3VA9274-0QB00	10915949 10973803	2	133	15	N/A					N/A				32 x 10	M10	133	15
3VA53	300-400	3VA9473-0JA13 3VA9474-0JA13	11002426 11039865	1	N/A		2 - 373	26	2 - 3/0 4/0 - 373	142 248	16 28	24	2 - 10	248	28	N/A			
		3VA9473-0JJ23 3VA9474-0JJ23	11002455 11039876	1 1	355	40	2/0 - 373	31 58	2/0 - 373	450	51	N/A							
		3VA9373-0JF60 3VA9374-0JF60	10973808 10973814	3 3	355	40	14 - 4	18 35	14 - 8 6 - 4	53 62	6 7								
		3VA9473-0QA00 3VA9474-0QA00	11002457 11039884	1	N/A		N/A					N/A				35 x 10	M10	355	40
3VA54	450-600	3VA9473-0QB00 3VA9474-0QB00	11002463 11039906	2	355	40	N/A					N/A				40 x 12.5	M10	177	20
3VA55	600-800	3VA9573-0JB23 3VA9574-0JB23	11039991 11040004	2	275	31	4/0 - 373	26	4/0 - 373	375	42.5	N/A				N/A			
		3VA9673-0JB32 3VA9674-0JB32	11050762 11050778	3	275	31	4/0 - 262	26	4/0 - 262	225	25.5								
		3VA9673-0JJ43 3VA9674-0JJ43	11050763 11050780	2 2	375	42.5	4/0 - 373	23 45	4/0 - 373	325	36.5								
		3VA9673-0QA00 3VA9674-0QA00	11050770 11050771	1	N/A		N/A					N/A				50 x 10	M10 x1 M10 x2	275	31

BUSBAR MOUNTING ADAPTORS

Manufacturer	Part #	HPN	# of Conn.	MOUNTING BOLTS Torque lb-in	MOUNTING BOLTS Torque N-m	LINE SIDE TUBES Torque lb-in	LINE SIDE TUBES Torque N-m
Wohner	32981	6077583	1	1.8	0.2	Preinstalled 4 AWG wire leads	
Siemens	8US1213-4AP03 8US1313-4AH03	10915871 10943617	1	71	8	89	10
	8US1213-4AH04 8US1313-4AM04	10943611 11039967	1	106	12	177	20

BUSBAR CONNECTION ADAPTORS

Manufacturer	Part #	HPN	# of Conn.	AWG	Max Busbar (mm)	Strip (mm)	Torque lb-in	Torque N-m
Wohner	01069	6251136	1	N/A	30 x 10	35	133	15
	01538	5960823	1	N/A	30 x 10	45	266	30
	01147	7861105	1	3/0 - 373	N/A	45	266	30
	01240	6679232	1	10 - 2/0	N/A	25	80	9
	01243	6257177	1	6 - 4/0	N/A	25	120	13.5
	32146	8010682	2	12 - 6	N/A	15	27	3

DISTRIBUTION BLOCKS

Manufacturer	Part #	HPN	POSTION		# of Conn.	AWG	Strip (mm)	Torque AWG	Torque lb-in	Torque N-m
Cooper Bussman	PDBFS303	6770277	Line / Load		1	4 - 313	32	4 - 313	275	31
	PDBFS330	5626032	Line		1	4 - 373	32	4 - 373	500	56.5
			Load	Row 1	3	14 - 4	30	6 - 4	45	5
				Row 2	3		15	8	40	4.5
								14 - 10	35	4
	PDBFS377	6197174	Line		2	4 - 262	30	4 - 262	275	31
							36			
			Load	Row 1	4	14 - 6	32	6	35	4
				Row 2	4		26	8	25	2.8
				Row 3	4		15	14 - 10	20	2.3
	PDBFS500	7500450	Line / Load		2	4 - 313	32	4 - 313	275	31
	PDBFS504	7500471	Line / Load		2	4 - 373	32	4 - 373	500	56.5
	16371-1 16371-3	5002820 2246870	Line		1	4 - 313	25	4 - 313	275	31
			Load	Row 1	3	14 - 2	25	* 14 - 2	120	13.5
				Row 2	3	14 - 6	16	6 - 4	45	5
				Row 3	3		12	8	40	4.5
								14 - 10	35	4
	16377-2 16377-3	4162385 4155603	Line	Row 1	1	4 - 4/0	25	4 - 4/0	275	31
				Row 2	1		32			
			Load	Row 1	4	14 - 6	25	6	35	4
				Row 2	4		16	8	25	2.8
				Row 3	4		12	14- 10	20	2.3
	16528-1 16528-3	3007511 2466523	Line		2	2 - 373	45	2 - 373	500	56.5
			Load	Row 1	2	6 - 2/0	32	* 6 - 2/0	120	13.5
					2	14 - 6		6	35	4
				Row 2	2	6 - 2/0	16	8	25	2.8
					2	14 - 6		14 - 10	20	2.3

* Larger termination screws

DISTRIBUTION BLOCKS

Manufacturer	Part #	HPN	POSTION		# of Conn.	AWG	Strip (mm)	Torque AWG	Torque lb-in	Torque N-m
Weidmueller	1028500000	7942923	Line		1	M10	N/A	N/A	133	15
			Load		1					
Marathon	1333575CH	8235602	Line		1	2 - 373	40	6 - 373	375	42.4
			Load	Row 1	2	14 - 1	32	6 - 1	120	13.5
				Row 2	2		16	8	40	4.5
								14 - 10	35	4
Ferraz Shawmut	63131	7147588	Line		1	14 - 1/0	17	6 - 1/0	120	13.5
								14 - 8	50	5.6
			Load	Row 1	2	14 - 6	22	6	35	4
				Row 2	2		10	8	25	2.8
								10 - 14	20	2.3

Refer to HS 252 for Mechanical Torque specifcations

CONTACTORS

					Ferrules		FLEXIBLE BUSBAR		LUGS / BUSBAR			
Manufacturer	Size	Part #	HPN	# of Conn.	AWG	Strip (mm)	Max Width (mm)	Thickness (mm)	Max Width (mm)	Bolt Size	Torque lb-in	Torque N-m
Siemens	S2 3RT203	BOX LUGS ATTACHED		1	18 - 2	13	N/A		N/A		35	4
				2	18 - 4							
	S3 3RT204	BOX LUGS ATTACHED		1	14 - 1	17	9	2.4 - 4.8	N/A		44	5
				2	14 - 2							
		WITHOUT BOX LUGS			N/A		N/A		15	M6		
	S6 3RT105	3RT1955-4G	2600404	1	6 - 2/0	20	15.5	2.4 - 4.8	N/A		97	11
				2	6 - 1/0							
		3RT1956-4G	2600407	1	6 - 262	20	15.5	2.4 - 8				
				2	6 - 3/0							
		WITHOUT BOX LUGS			N/A		N/A		17	M8		
	S10 3RT106	3RT1966-4G	2600408	1	3/0-373	27	24	4.8 - 10	N/A		177	20
				2	2/0-373							
		WITHOUT BOX LUGS			N/A		N/A		25	M10		
	S12 3RT107	3RT1966-4G	2600408	1	3/0-373	27	24	4.8 - 10	N/A		177	20
				2	2/0-373							
		WITHOUT BOX LUGS			N/A		N/A		25	M10		

WIRE GAGE	
AWG	mm²
26	0.14
24	0.25
22	0.34
20	0.5
19	0.75
18	1.0
16	1.5
14	2.5
12	4
10	6
8	10
6	16
4	25
2	35
1	50

OVERLOAD RELAYS

					Ferrules		LUGS / BUSBAR			
Manufacturer	Size	Part #	HPN	# of Conn.	AWG	Strip (mm)	Max Width (mm)	Bolt Size	Torque lb-in	Torque N-m
Siemens	S2 3RU213	BOX LUGS ATTACHED		1	18 - 2	13	N/A		35	4
				2	18 - 4					
	S3 3RU214	BOX LUGS ATTACHED		1	14 - 1	17	N/A		44	5
				2	14 - 2					
	S6 3RB205	RT1955-4G	2600404	1	6 - 2/0	20	N/A		97	11
				2	6 - 1/0					
		RT1956-4G	2600407	1	6 - 262	20				
				2	6 - 3/0					
		WITHOUT BOX LUGS			N/A		15	M8		
	S10 3RB206	RT1966-4G	2600408	1	3/0 - 373	27	N/A		177	20
				2	2/0 - 373					
		WITHOUT BOX LUGS			N/A		25	M10		

STUD SIZE	
USA	METRIC
#2	M2
#4	M2.5
#5	M3
#6	M3.5
#8	M4
#10	M5
1/4"	M6
5/16"	M8
3/8"	M10
7/16"	M11
1/2"	M12
5/8"	M16

Refer to HS 252 for Mechanical Torque specifcations

MOTOR STARTER PROTECTORS

					Ferrules		LUGS / BUSBAR		Torque	
Manufacturer	Size	Part #	HPN	# of Conn.	AWG	Strip (mm)	Max Width (mm)	Bolt Size	lb-in	N-m
Siemens	S2 3RV203	BOX LUGS ATTACHED		1	18 - 2	13	N/A		35	4
				2	18 - 4					
	S3 3RV204 3RV274	BOX LUGS ATTACHED		1	14 - 1	17	N/A		44	5
				2	14 - 2					
		WITHOUT BOX LUGS			N/A		15	M6		

MACHINE / MOLD HEATS

					Ferrules		LUGS / BUSBAR		Torque	
Manufacturer	Type	Part #	HPN	# of Conn.	AWG	Strip (mm)	Max Width (mm)	Bolt Size	lb-in	N-m
Siemens	5SY4	(1,2,3)-Pole		2	14 - 4	15	N/A		27	3
	SITOP	6EP1437-3BA10 6EP4137-3AB00	8098974 7829488	2	14 - 6	12			11	1.2
Wohner	AES-CC	31298 31299	4985144 4985089	1	14 - 8	11			20	2.3
		31300	4986413		6 - 4				25	2.8
	CTB-T35	31550	4985169	1	10 - 1/0	15			50	5.6
ABA	6 Slot	ICC3.2	7869129	1	N/A		15	M5	20	2.3

PE CONNECTIONS

Manufacturer	Part #	HPN	# of Conn.	AWG	Strip (mm)	Bolt Size	Torque lb-in	Torque N-m
Brumall	1024-R0	2172625	1	6 - 262	22	N/A	375	42.4
			24	8	10		40	4.5
				14 - 10			35	4
Hoffman	10 Hole PE busbar	2617195	8	N/A		M8	89	10
			2			M10	177	20
	6 Hole PE busbar	3086616	3	N/A		M8	89	10
			3			M10	177	20
	PE stud	N/A	1	N/A		M6	20	2.3

Refer to HS 252 for Mechanical Torque specifcations

LINE FILTERS

				POWER CONNECTIONS					PE CONNECTION		
Manufacturer	Part #	HPN	Size	max. AWG	Strip (mm)	Bolt Size	Torque lb-in	Torque N-m	Bolt Size	Torque lb-in	Torque N-m
BAUMULLER (A211)	BFN 3-1-030-001	2351717	30A	8	9	N/A	9	1	M5	18	2
	BFN 3-1-042-001	2351719	42A								
	BFN 3-1-056-001	2351721	56A	6	10		15	1.7	M6	35	4
	BFN 3-1-075-001	2351722	75A	4	19		35	4			
	BFN 3-1-100-001	2351723	100A	1	24		62	7	M10	53	6
	BFN 3-1-130-001	2351724	130A								
	BFN 3-1-180-001	2351726	180A	3/0	27		142	16			
	BFN 3-1-250-001	4683445	250A	N/A		M10	142	16		142	16
	BFN 3-1-270-001	2620271	270A			M12	221	25		53	6
	BFN 3-1-320-101	4570913	320A			M10	142	16	Same as POWER CONNECTIONS		
	BFN 3-1-400-101	4684162	400A								
	BFN 3-1-600-101	4684158	600A								
SIEMENS (A211)	6SL3000-0BE21-6DA0	5157016	16kW	8	10	N/A	15	1.7	M6	53	6
	6SL3203-0BE31-1BA0	7375741	37kW	2	24	N/A	62	7	M10	89	10
	6SL3203-0BE32-5AA0	6884295	132kW	N/A		M10	221	25	N/A		

WIRE GAGE	
AWG	mm²
26	0.14
24	0.25
22	0.34
20	0.5
19	0.75
18	1.0
16	1.5
14	2.5
12	4
10	6
8	10
6	16
4	25
2	35
1	50

STUD SIZE	
USA	METRIC
#2	M2
#4	M2.5
#5	M3
#6	M3.5
#8	M4
#10	M5
1/4"	M6
5/16"	M8
3/8"	M10
7/16"	M11
1/2"	M12
5/8"	M16

Refer to HS 252 for Mechanical Torque specifcations

LINE REACTORS

				POWER CONNECTIONS					PE CONNECTION		
Manufacturer	Part #	HPN	Size	max. AWG	Strip (mm)	Bolt Size	Torque lb-in	Torque N-m	Bolt Size	Torque lb-in	Torque N-m
BAUMULLER (A218)	BK3-0040/0050-002	6344019	40A	6	15	N/A	9	3	M6	53	6
	BK3-0065/0080-002	11005628	65A	4	18						
	BK3-0080/0100-002	11005647	80A	1	24		53	6			
	BK3-0115/0140-002	11005650	115A						M8	106	12
	BK3-0065/0080-001	5831222	65A	N/A		M6	53	6	M6	53	6
	BK3-0080/0100-001	5831202	80A			M8	106	12			
	BK3-0115/0140-001	4922039	115A			M10	133	15	M8	106	12
	BK3-0165/0200-001	4684155	165A								
	BK3-0195/0240-001	4921887	195A								
	BK3-0275/0340-001	4121316	275A								
	BK3-0365/0450-001	4420121	365A			M12	177	20			
	BK3-0450/0550-001	4922113	450A								
	BK3-0615/0750-001	4684150	615A								
SIEMENS (A194)	6SL3000-0DE21-6AA0	4858572	16 kW	6	14	N/A	11	1.2	Same as POWER CONNECTIONS		
	6SL3000-0DE23-6AA0	4858565	36 kW	2	19		22	2.5			
	6SL3000-0DE25-5AA1	3687230	55 kW	1/0	24		62	7			
	6SL3000-0DE28-0AA1	4858569	80 kW	4/0	35		SPRING CLAMP		M10	221	25
	6SL3000-0DE31-2AA1	4858567	120 kW								

WIRE GAGE	
AWG	mm²
26	0.14
24	0.25
22	0.34
20	0.5
19	0.75
18	1.0
16	1.5
14	2.5
12	4
10	6
8	10
6	16
4	25
2	35
1	50

STUD SIZE	
USA	METRIC
#2	M2
#4	M2.5
#5	M3
#6	M3.5
#8	M4
#10	M5
1/4"	M6
5/16"	M8
3/8"	M10
7/16"	M11
1/2"	M12
5/8"	M16

Refer to HS 252 for Mechanical Torque specifcations

ACTIVE INTERFACE MODULES

				POWER CONNECTIONS					PE CONNECTION		
Manufacturer	Part #	HPN	Size	max. AWG	Strip (mm)	Bolt Size	Torque lb-in	Torque N-m	Bolt Size	Torque lb-in	Torque N-m
SIEMENS (A195)	6SL3100-0BE21-6AB0	4959543	16 kW	6	14	N/A	15	1.7	M8	115	13
	6SL3100-0BE23-6AB0	5854353	36 kW	1/0	24		53	6			
	6SL3100-0BE25-5AB0	4021256	55 kW								
	6SL3100-0BE28-0AB0	4021251	80 kW	N/A		M8	115	13			
	6SL3100-0BE31-2AB0	4021250	120 kW								

ACTIVE LINE MODULES

				POWER CONNECTIONS					PE CONNECTION			DC LINK BUSBAR	
Manufacturer	Part #	HPN	Size	max. AWG	Strip (mm)	Bolt Size	Torque lb-in	Torque N-m	Bolt Size	Torque lb-in	Torque N-m	Torque lb-in	Torque N-m
SIEMENS (A20)	6SL3130-7TE21-6AA4	4959545	16 kW	8	12	N/A	15	1.7	M5	27	3	15.9	1.8
	6SL3130-7TE23-6AA3	5682121	36 kW	N/A		M6	53	6	M6	53	6		
	6SL3130-7TE25-5AA3 6SL3131-7TE25-5AA3	5808068 7260842	55 kW			M8	115	13					
	6SL3130-7TE28-0AA3 6SL3131-7TE28-0AA3	3890439 6849701	80 kW						M8	115	13		
	6SL3130-7TE31-2AA3 6SL3131-7TE31-2AA3	3869320 6849702	120 kW										
	6SL3162-2BM01-0AA0	3869348	DC link	4/0	25	N/A	115	13	N/A				

WIRE GAGE	
AWG	mm²
26	0.14
24	0.25
22	0.34
20	0.5
19	0.75
18	1.0
16	1.5
14	2.5
12	4
10	6
8	10
6	16
4	25
2	35
1	50

STUD SIZE	
USA	METRIC
#2	M2
#4	M2.5
#5	M3
#6	M3.5
#8	M4
#10	M5
1/4"	M6
5/16"	M8
3/8"	M10
7/16"	M11
1/2"	M12
5/8"	M16

Refer to HS 252 for Mechanical Torque specifcations

SERVO DRIVES

				POWER CONNECTIONS					PE CONNECTION			DC LINK BUSBAR	
Manufacturer	Part #	HPN	Size	max. AWG	Strip (mm)	Bolt Size	Torque lb-in	Torque N-m	Bolt Size	Torque lb-in	Torque N-m	Torque lb-in	Torque N-m
BAUMULLER (209)	BM4434 BM4435	8425222 8425223	40A 60A	4	16	N/A	18	2	Same as POWER CONNECTIONS			N/A	
	BM4443	8425143	80A	1	24	N/A	62	7					
	BM4444	8098421	100A										
	BM4445	8098423	130A										
	BM4446	8098425	150A										
	BM4453	8098510	150A	N/A		M8	106	12					
	BM4454	8098511	210A										
	BM4462	8098635	250A			M10	133	15					
	BM4463	8098636	300A										
	BM4466	8098637	350A										
	BM4472	8098684	450A										
	BM4473	8098685	594A										
SIEMENS (A23) (A235) (A41, A42) (A55)	6SL3120-1TE24-5AA3 6SL3121-1TE24-5AA3	3869422 7260827	45 A	N/A		M6	53	6	M6	53	6	15.9	1.8
	6SL3120-1TE26-0AA3 6SL3121-1TE26-0AA3	4870136 6849696	60 A										
	6SL3120-1TE28-5AA3 6SL3121-1TE28-5AA3	4054901 6849698	85 A			M8	115	13		115	13		
	6SL3120-1TE31-3AA3 6SL3121-1TE31-3AA3	4054899 6849699	132 A						M8				
	6SL3120-1TE32-0AA4 6SL3121-1TE32-0AA4	3869421 6849700	200 A										
	6SL3210-1PE27-5UL0	7251771	37 kW	2	18	N/A	35	4	Same as POWER CONNECTIONS			N/A	
	6SL3210-1PE31-1UL0	7251769	55 kW	2/0	25	N/A	80	9					
	6SL3210-1PE31-8UL0	7162332	90 kW	N/A		M10	212	24					
	6SL3210-1PE32-5UL0	6852710	132 kW										

WIRE GAGE	
AWG	mm²
26	0.14
24	0.25
22	0.34
20	0.5
19	0.75
18	1.0
16	1.5
14	2.5
12	4
10	6
8	10
6	16
4	25
2	35
1	50

STUD SIZE	
USA	METRIC
#2	M2
#4	M2.5
#5	M3
#6	M3.5
#8	M4
#10	M5
1/4"	M6
5/16"	M8
3/8"	M10
7/16"	M11
1/2"	M12
5/8"	M16

Refer to HS 252 for Mechanical Torque specifcations

SERVO MOTORS

					POWER CONNECTIONS			PE CONNECTION		
Manufacturer	Part #	HPN	Motor Size	Terminal Box #	Bolt Size	Torque lb-in	Torque N-m	Bolt Size	Torque lb-in / N-m	Cable Entry Ø
BAUMULLER	DS2-100LO54W-20-5	8008538	100	12	M8	53	6	Same as POWER CONNECTIONS		M40 x 1 M25 x 1
	DS2-100KO54W-30-5	8008324								
	DS2-100MO54W-30-5	8008338								
	DS2-100BO54W-20-5	8008540 8135668		14						M63 x 1 M25 x 1
	DS2-100LO54W-30-5	8008350								
	DS2-100BO54W-30-5	8008351 8012949								
	DS2-132MO54W-20-5	8025038	132	22						M40 x 2 M25 x 1
	DS2-132ML54W-30-5	8008355 8010220		24						M63 x 2 M25 x 1
	DS2-132MO54W-30-5	8008356 8012948								
	DS2-132LO54W-30-5	8008354		26	M10	89	10			
	DS2-132BO54W-30-5	8008353 8012942								
	DS2-160KO54W-30-5	8012944	160	32						64 x 2 25.5 x 1
	DS2-160MO54W-30-5	8008366 8012945		34	M12	89	15.5			76 x 2 25.5 x 1
	DS2-160LO54W-30-5	8008358 8012946								
	DS2-160BO54W-30-5	8008357 8012947								
	DS2-200LO54W-27-5	8020273	200	46	M16	89	10			51 x 6 25.5 x 1 40.5 x 2
	DS2-200MO54W-27-5	8020002								

WIRE GAGE	
AWG	mm²
26	0.14
24	0.25
22	0.34
20	0.5
19	0.75
18	1.0
16	1.5
14	2.5
12	4
10	6
8	10
6	16
4	25
2	35
1	50

STUD SIZE	
USA	METRIC
#2	M2
#4	M2.5
#5	M3
#6	M3.5
#8	M4
#10	M5
1/4"	M6
5/16"	M8
3/8"	M10
7/16"	M11
1/2"	M12
5/8"	M16

Refer to HS 252 for Mechanical Torque specifcations

PUMP MOTORS

Data Sheets

			POWER CONNECTIONS					PE CONNECTION				
Manufacturer	HP	# of Conn.	AWG	Strip (mm)	Bolt Size	Torque lb-in	Torque N-m	AWG	Strip (mm)	Torque lb-in	Torque N-m	Cable Entry Ø
EMOD	20 - 60	6	N/A		M8	53	6	10 - 1/0	20	71	8	Pg13 x 7 Pg11 x 2
	60 - 100											Pg16 x 7 Pg11 x 2
	100 - 125	6			M10	89	10	1 - 373				Pg21 x 7 Pg11 x 2
	125 - 150	6			M12	137	15.5					
	200 - 250	6	4 - 4/0	35	N/A	Cage Clamp *		Same as POWER CONNECTIONS				M40 x 7 M20 x 1
	200 - 600	12										M32 x 13 M20 x 1

* WAGO TYPE 285-195 -> USE BARE DLO (NO STOPPER)

WIRE GAGE	
AWG	mm²
26	0.14
24	0.25
22	0.34
20	0.5
19	0.75
18	1.0
16	1.5
14	2.5
12	4
10	6
8	10
6	16
4	25
2	35
1	50

STUD SIZE	
USA	METRIC
#2	M2
#4	M2.5
#5	M3
#6	M3.5
#8	M4
#10	M5
1/4"	M6
5/16"	M8
3/8"	M10
7/16"	M11
1/2"	M12
5/8"	M16

Refer to HS 252 for Mechanical Torque specifcations

CLASS A --> Electrical threaded connections (>30A)	
#	Connection Type
1	DLO Conductors
2	Non DLO Conductors (>=8AWG)
3	Flexible Busbars
4	Busbar Connection / Mounting Adaptors
5	Comb-Type Busbars
6	SINAMICS DC Link busbars
7	Main Breaker Lug Mounting Bolts

CLASS A NOTES:

All Class A connections shall use Torque Record Report

CLASS A TORQUE RECORD REPORT
Lookup torque values must be predefined prior to assembly
Operator to record name for each torqued connection point
Inspector to record name for each verification point
This report is a CTQ supplier deliverable
This report will be available for post build reference
Refer to SWI-2551

Torque value reference:

1. Husky DLO Tables
2. HS252
3. Specials -> OEM installation guide

CLASS B --> Electrical threaded connections (<=30A)	
#	Connection Type
1	Non DLO Conductors (<=10AWG)
2	Distribution Blocks (load side)
3	5SY Circuit Breakers
4	AES-QC Fuse holders
5	Control Transformers *
6	DC power supplies *
7	Buffer Module *
8	RV surge suppressors *
9	Outlets *
10	Control Relays *
11	Heat Exchangers *
12	Grounding Studs
13	Bonding Straps

CLASS B NOTES:

All Class B connections shall be tightened and tug tested

* Future design change to spring cage terminals

CLASS C --> Device Mounting	
#	Mounting Type
1	Busbar supports
2	Busbar Adaptors
3	Breakers
4	Breaker Handles
5	Distribution Blocks
6	Contactors
7	Line Filters
8	Line Reactors
9	Servo Drives
10	Heat Sink
11	Solid State Relays
12	Altanium Components
13	IPC / Battery
14	Din Rail
15	Wire Duct
16	Connector bulkheads / hoods
17	Strain Relieves / Gland Plates
18	Enclosure - Accessories
19	Adaptor plates
20	Current Transformers