

Bolt Torque Information—Supplement to Fisher® 249 Sensor Instruction Manuals

Recommended Bolt Tightening Procedure

1. Start with all fasteners hand-tight.
2. Progressively tighten all fasteners in a standard criss-cross pattern. Use multiple passes of increasing torque increments until the maximum desired torque has been reached.
3. Make the final passes in a circular pattern until there is no bolt movement at the maximum torque for 1 complete pass.
4. For steam service and other high temperature applications, it is beneficial if the unit(s) can be heated up and then cooled down after step 3, and then step 3 repeated.

Lubrication Recommendations

NCF2 coated fasteners can be used either with or without additional lubrication:

- If the fasteners are used without additional lubricant, use the torque values for uncoated fasteners with Molykote® 321R Spray-Bonded Lubricant or equivalent.
- If additional lubricant is applied to the NCF2 coated fasteners, use the torque values for the lubricant that is being used.

249		TORQUE (ft•lb)							
		LUBRICANT (Studs and Nuts Uncoated)							
		Joint Description	Size	Part Number	Standard Material	STUDS & NUTS	Molykote	Lubriplate®	Never-Seez®
NCF2(*) COATED	321R or Equivalent					Mag-1 or Equivalent	Nickel Special or Equivalent	or FFS3C6	
CL125 CL250	Torque Tube Retaining Flange:	3/8 - 16	17B1392X082	SA193-B7 NCF2	25 +/- 4	25 +/- 4	31 +/- 5	30 +/- 5	16.3 +/- 2
		3/8 - 16	17B1392X082	SA193-B7 NCF2	25 +/- 4	25 +/- 4	31 +/- 5	30 +/- 5	16.3 +/- 2
		3/8 - 16	17B1392X042	SA193-B8M CL1	N/A	11 +/- .5	14 +/- 1	13.3 +/- .7	7.3 +/- .4
		3/8 - 16	17B1392X042	SA193-B8M CL1	N/A	11 +/- .5	14 +/- 1	13.3 +/- .7	7.3 +/- .4
CL125 CL250	Torque Tube Arm / Head: (Cap Screws)	1/2 - 13	1A5147X0112	SA193-B7 NCF2	56 +/- 8	56 +/- 8	71 +/- 10	67 +/- 10	37 +/- 6
		5/8 - 11	1A9362X0092	SA193-B7 NCF2	97 +/- 14	97 +/- 14	125 +/- 19	120 +/- 18	64 +/- 10
		1/2 - 13	1A5147X0012	SA193-B8M CL1	N/A	26 +/- 1	33 +/- 1.5	32 +/- 1.5	17.3 +/- .9
		5/8 - 11	1A9362X0012	SA193-B8M CL1	N/A	51 +/- 2.5	65 +/- 3	62 +/- 3	34 +/- 1.7
CL125 CL250	Cage / Head: (Cap Screws)	1/2 - 13	12B5478X052	SA193-B7 NCF2	56 +/- 8	56 +/- 8	71 +/- 10	67 +/- 10	37 +/- 6
		3/4 - 10	1A3534X0092	SA193-B7 NCF2	155 +/- 23	155 +/- 23	200 +/- 30	190 +/- 29	101 +/- 15
		1/2 - 13	12B5478X022	SA193-B8M CL1	N/A	26 +/- 1	33 +/- 1.5	32 +/- 1.5	17.3 +/- .9
		3/4 - 10	1A3534X0032	SA193-B8M CL1	N/A	89 +/- 4.5	115 +/- 6	110 +/- 5.5	59 +/- 3

(*) Torque values for NCF2 without additional lubricant are equal to Molykote 321R



249B: CL150 - CL600				TORQUE (ft•lb)				
				LUBRICANT (Studs and Nuts Uncoated)				
				STUDS & NUTS NCF2(*) COATED	Molykote 321R or Equivalent	Lubriplate Mag-1 or Equivalent	Never-Seez Nickel Special or Equivalent	FFS3C3 or FFS3C6
Joint Description	Size	Part Number	Standard Material					
Torque Tube Retaining Flange:	3/8 - 16	17B1392X082	SA193-B7 NCF2	25 +/- 4	25 +/- 4	31 +/- 5	30 +/- 5	16.3 +/- 2
	3/8 - 16	17B1392X092	SA193-B7M NCF2	22 +1/-3	22 +1/-3	26 +1/-4	25 +1/-4	14.4 +.7/-2
Torque Tube Arm / Head:	5/8 - 11	1A3544X0312	SA193-B7 NCF2	97 +/- 14	97 +/- 14	125 +/- 19	120 +/- 18	64 +/- 10
	5/8 - 11	1A3544X0322	SA193-B7M NCF2	97 +10/-15	97 +10/-15	125 +13/-19	120 +12/-8	64 +3/-10
Cage / Head (249B) or Blind Flange / Cage (259B):	3/4 - 10	1A3543X0222	SA193-B7 NCF2	155 +/- 23	155 +/- 23	200 +/- 28	190 +/- 29	101 +/- 15
	3/4 - 10	1A3543X0232	SA193-B7M NCF2	155 +16/-23	155 +16/-23	200 +20/-30	190 +19/-29	101 +5/-15

(*) Torque values for NCF2 without additional lubricant are equal to Molykote 321R

249C: CL150 - CL600				TORQUE (ft•lb)				
				LUBRICANT (Studs and Nuts Uncoated)				
				STUDS & NUTS NCF2(*) COATED	Molykote 321R or Equivalent	Lubriplate Mag-1 or Equivalent	Never-Seez Nickel Special or Equivalent	FFS3C3 or FFS3C6
Joint Description	Size	Part Number	Standard Material					
Torque Tube Retaining Flange:	3/8 - 16	17B1392X082	SA193-B7 NCF2	25 +/- 4	25 +/- 4	31 +/- 5	30 +/- 5	16.3 +/- 2
	3/8 - 16	17B1392X032	SA193-B8M CL2	N/A	23 +1/-3	27 +1/-4	26 +1/-4	14.4 +.7/-2
	3/8 - 16	17B1392X092	SA193-B7M NCF2	22 +1/-3	22 +1/-3	26 +1/-4	25 +1/-4	14.4 +.7/-2
Torque Tube Arm / Head:	5/8 - 11	1A3544X0312	SA193-B7 NCF2	97 +/- 14	97 +/- 14	125 +/- 18	120 +/- 18	64 +/- 10
	5/8 - 11	1A3544X0322	SA193-B8M CL2	N/A	97 +10/-15	125 +13/-19	120 +12/-18	64 +3/-10
	5/8 - 11	1A3544X0322	SA193-B7M NCF2	97 +10/-15	97 +10/-15	125 +13/-19	120 +12/-18	64 +3/-10
Cage / Head:	7/16 - 14	1A8835X0242	SA193-B7 NCF2	39 +/- 5	39 +/- 5	50 +/- 7	47 +/- 7	26 +/- 4
	7/16 - 14	1A8835X0222	SA193-B8M CL2	N/A	37 +2/-6	43 +2/-6	42 +2/-6	23 +1/-3
	7/16 - 14	1A8835X0252	SA193-B7M NCF2	37 +2/-6	43 +2/-6	37 +2/-6	42 +2/-6	23 +1/-3

(*) Torque values for NCF2 without additional lubricant are equal to Molykote 321R

249BP: CL150 - CL600				TORQUE (ft•lb)					
				STUDS & NUTS NCF2(*) COATED	LUBRICANT (Studs and Nuts Uncoated)				
					Molykote 321R or Equivalent	Lubriplate Mag-1 or Equivalent	Never-Seez Nickel Special or Equivalent	FFS3C3 or FFS3C6	
Joint Description	Size	Part Number	Standard Material						
Torque Tube Retaining Flange:	3/8 - 16	17B1392X082	SA193-B7 NCF2	25 +/- 4	25 +/- 4	31 +/- 5	30 +/- 5	16.3 +/- 2	
	3/8 - 16	17B1392X032	SA193-B8M CL2	N/A	23 +1/-3	27 +1/-4	26 +1/-4	14.4 +/- 7/-2	
	3/8 - 16	17B1392X092	SA193-B7M NCF2	22 +1/-3	22 +1/-3	26 +1/-4	25 +1/-4	14.4 +/- 7/-2	
Torque Tube Arm / Head:	5/8 - 11	1A3544X0312	SA193-B7 NCF2	97 +/- 14	97 +/- 14	125 +/- 18	120 +/- 18	64 +/- 10	
	5/8 - 11	1A354435222	SA193-B8M CL2	N/A	97 +10/-15	125 +13/-19	120 +12/-18	64 +3/-10	
	5/8 - 11	1A3544X0322	SA193-B7M NCF2	97 +10/-15	97 +10/-15	125 +13/-19	120 +12/-18	64 +3/-10	
Top Flange — CL150:	5/8 - 11	1J6981X0232	SA193-B7 NCF2	97 +/- 14	97 +/- 14	125 +/- 18	120 +/- 18	64 +/- 10	
	CL300:	5/8 - 11	1L5151X0142	SA193-B7 NCF2	97 +/- 14	97 +/- 14	120 +/- 18	120 +/- 18	64 +/- 10
	CL600:	5/8 - 11	1A4875X0142	SA193-B7 NCF2	97 +/- 14	97 +/- 14	125 +/- 18	120 +/- 18	64 +/- 10

(*) Torque values for NCF2 without additional lubricant are equal to Molykote 321R

249CP: CL150 - CL600				TORQUE (ft•lb)				
				STUDS & NUTS NCF2(*) COATED	LUBRICANT (Studs and Nuts Uncoated)			
					Molykote 321R or Equivalent	Lubriplate Mag-1 or Equivalent	Never-Seez Nickel Special or Equivalent	FFS3C3 or FFS3C6
Joint Description	Size	Part Number	Standard Material					
Torque Tube Retaining Flange:	3/8 - 16	17B1392X082	SA193-B7 NCF2	25 +/- 4	25 +/- 4	31 +/- 5	30 +/- 5	16.3 +/- 2
	3/8 - 16	17B1392X032	SA193-B8M CL2	N/A	23 +1/-3	27 +1/-4	26 +1/-4	14.4 +/- 7/-2
Torque Tube Arm / Head:	5/8 - 11	1A3544X0312	SA193-B7 NCF2	97 +/- 14	97 +/- 14	125 +/- 18	120 +/- 18	64 +/- 10
	5/8 - 11	1A354435222	SA193-B8M CL2	N/A	94 +10/-15	125 +13/-19	120 +12/-18	64 +3/-10

(*) Torque values for NCF2 without additional lubricant are equal to Molykote 321R

249P: CL900 - CL1500				TORQUE (ft•lb)				
				STUDS & NUTS NCF2(*) COATED	LUBRICANT (Studs and Nuts Uncoated)			
					Molykote 321R or Equivalent	Lubriplate Mag-1 or Equivalent	Never-Seez Nickel Special or Equivalent	FFS3C3 or FFS3C6
Joint Description	Size	Part Number	Standard Material					
Torque Tube Retaining Flange:	1/2 - 13	1K6235X0152	SA193-B7 NCF2	56 +/- 8	56 +/- 8	71 +/- 10	67 +/- 10	37 +/- 6
	1/2 - 13	1K6235X0162	SA193-B7M NCF2	56 +3/-8	56 +3/-8	66 +3/-10	64 +3/-10	34 +2/-5
Torque Tube Arm / Head:	7/8 - 9	1A4212X0042	SA193-B7 NCF2	230 +35/-23	230 +35/-23	290 +44/-29	275 +41/-28	149 +22/-15
	7/8 - 9	1A4212X0032	SA193-B7M NCF2	230 +23/-35	230 +23/-35	290 +29/-44	275 +28/-41	149 +15/-22

(*) Torque values for NCF2 without additional lubricant are equal to Molykote 321R

249V (OBSOLETE)					TORQUE (ft•lb)				
					LUBRICANT (Studs and Nuts Uncoated)				
Joint Description	Size	Part Number	Standard Material	STUDS & NUTS NCF2(*) COATED	Molykote 321R or Equivalent	Lubriplate Mag-1 or Equivalent	Never-Seez Nickel Special or Equivalent	FFS3C3 or FFS3C6	
CL125-600	Torque Tube	3/8 - 16	17B1392X082	SA193-B7 NCF2	25 +/- 4	25 +/- 4	31 +/- 5	30 +/- 5	16.3 +/- 2
CL125-600	Retaining Flange:	3/8 - 16	17B1392X092	SA193-B7M NCF2	22 +1/-3	22 +1/-3	26 +1/-4	25 +1/-4	14.4 +/- 7/-2
CL900-1500		1/2 - 13	1K6235X0152	SA193-B7 NCF2	56 +/- 8	56 +/- 8	71 +/- 10	67 +/- 10	37 +/- 6
CL2500-6000		1/2 - 13	1K6235X0152	SA193-B7 NCF2	56 +/- 8	56 +/- 8	71 +/- 10	67 +/- 10	34 +/- 5

(*) Torque values for NCF2 without additional lubricant are equal to Molykote 321R

249VS: CL125-CL2500					TORQUE (ft•lb)				
					LUBRICANT (Studs and Nuts Uncoated)				
Joint Description	Size	Part Number	Standard Material	STUDS & NUTS NCF2(*) COATED	Molykote 321R or Equivalent	Lubriplate Mag-1 or Equivalent	Never-Seez Nickel Special or Equivalent	FFS3C3 or FFS3C6	
Torque Tube Retaining Flange:	1/2 - 13	1K6235X0152	SA193-B7 NCF2	56 +/- 8	56 +/- 8	71 +/- 10	67 +/- 10	37 +/- 6	
	1/2 - 13	1K6235X0162	SA193-B7M NCF2	56 +3/-8	56 +3/-8	66 +3/-10	64 +3/-10	34 +/- 5	
	1/2 - 13	1K6235X0012	SA193-B8M CL2	N/A	56 +3/-8	66 +3/-10	64 +3/-10	34 +/- 5	

(*) Torque values for NCF2 without additional lubricant are equal to Molykote 321R

249K: CL900 - CL1500					TORQUE (ft•lb)				
					LUBRICANT (Studs and Nuts Uncoated)				
Joint Description	Size	Part Number	Standard Material	STUDS & NUTS NCF2(*) COATED	Molykote 321R or Equivalent	Lubriplate Mag-1 or Equivalent	Never-Seez Nickel Special or Equivalent	FFS3C3 or FFS3C6	
Torque Tube Retaining Flange:	1/2 - 13	1K6235X0152	SA193-B7 NCF2	56 +/- 8	56 +/- 8	71 +/- 10	67 +/- 10	37 +/- 6	
Torque Tube Arm / Head:	7/8 - 9	1A3771X0092	SA193-B7 NCF2	230 +35/-23	230 +35/-23	290 +44/-29	275 +41/-28	149 +22/-15	
Cage/Head:	1 - 8	1C7725X0102	SA193-B7 NCF2	320 +48/-16	320 +48/-16	405 +60/-20	385 +57/-19	210 +31/-10	

(*) Torque values for NCF2 without additional lubricant are equal to Molykote 321R

249L: CL2500				TORQUE (ft•lb)				
				LUBRICANT (Studs and Nuts Uncoated)				
Joint Description	Size	Part Number	Standard Material	STUDS & NUTS NCF2(*) COATED	Molykote 321R or Equivalent	Lubriplate Mag-1 or Equivalent	Never-Seez Nickel Special or Equivalent	FFS3C3 or FFS3C6
Torque Tube Retaining Flange:	1/2 - 13	1K6235X0152	SA193-B7 NCF2	56 +/- 8	56 +/- 8	71 +/- 10	67 +/- 10	37 +/- 6
Torque Tube Arm / Head:	1 1/8 - 8	1A2033X0092	SA193-B7 NCF2	430 +63/-21	430 +63/-21	550 +81/-27	525 +75/-25	280 +42/-14
Cage/Head:	1 1/2 - 8	1A5010X0082	SA193-B7 NCF2	1000 +150/-50	1000 +150/-50	1290 +195/-65	1220 +183/-61	630 +95/-32
Top Blind Flange:	7/8 - 9	1A3657X0322	SA193-B7 / NCF2	230 +35/-23	230 +35/-23	290 +44/-29	275 +41/-28	149 +22/-15

(*) Torque values for NCF2 without additional lubricant are equal to Molykote 321R

249W - CL150 - CL600				TORQUE (ft•lb)				
				LUBRICANT (Studs and Nuts Uncoated)				
Joint Description	Size	Part Number	Standard Material	STUDS & NUTS NCF2(*) COATED	Molykote 321R or Equivalent	Lubriplate Mag-1 or Equivalent	Never-Seez Nickel Special or Equivalent	FFS3C3 or FFS3C6
Torque Tube Retaining Flange:	3/8 - 16	17B1392X082	SA193-B7 NCF2	25 +/- 4	25 +/- 4	31 +/- 5	30 +/- 5	16.3 +/- 2
	3/8 - 16	17B1392X032	SA193-B8M CL2	N/A	23 +1/-3	27 +1/-4	26 +1/-4	14.4 +.7/-2
	3/8 - 16	17B1392X092	SA193-B7M NCF2		22 +1/-3	22 +1/-3	26 +1/-4	25 +1/-4
Torque Tube Arm / Head:	5/8 - 11	1A3544X0312	SA193-B7 NCF2	97 +/- 14	97 +/- 14	125 +/- 18	120 +/- 18	64 +/- 10
	5/8 - 11	1A354435222	SA193-B8M CL2	N/A	97 +10/-15	125 +13/-19	120 +12/-18	64 +3/-10
	5/8 - 11	1A3544X0322	SA193-B7M NCF2		97 +10/-15	97 +10/-15	125 +13/-19	120 +12/-18

				TORQUE (ft•lb)				
				LUBRICANT (Studs and Nuts Uncoated)				
Mating Flange Size & Class	Size	Line Bolt and Nut Material		STUDS & NUTS NCF2(*) COATED	Molykote 321R or Equivalent	Lubriplate Mag-1 or Equivalent	Never-Seez Nickel Special or Equivalent	FFS3C3 or FFS3C6
3" CL150	5/8 - 11	SA193-B7 / 2H		97 +/- 14	97 +/- 14	125 +/- 19	120 +/- 18	64 +/- 10
3" CL300	3/4 - 10			155 +/- 23	155 +/- 23	200 +/- 28	190 +/- 29	101 +/- 15
3" CL600	3/4 - 10			155 +/- 23	155 +/- 23	200 +/- 28	190 +/- 29	101 +/- 15
3" CL150	5/8 - 11	SA193-B7M / 2HM		97 +10/-15	97 +10/-15	125 +13/-19	120 +12/-18	64 +3/-10
3" CL300	3/4 - 10			155 +16/-23	155 +16/-23	200 +20/-30	190 +19/-29	101 +5/-15
3" CL600	3/4 - 10			155 +16/-23	155 +16/-23	200 +20/-30	190 +19/-29	101 +5/-15
3" CL150	5/8 - 11	SA193-B8M CL2 / 8M		N/A	97 +10/-15	125 +13/-19	120 +12/-18	64 +3/-10
3" CL300	3/4 - 10			N/A	155 +16/-23	200 +20/-30	190 +19/-29	101 +5/-15
3" CL600	3/4 - 10			N/A	155 +16/-23	200 +20/-30	190 +19/-29	101 +5/-15

(*) Torque values for NCF2 without additional lubricant are equal to Molykote 321R

Recommended Pipe Plug Installation Procedure

Torque values are not used when tightening NPT pipe threaded connections. Rather, we follow American National Standard ANSI / ASME B1.20.1, where thread engagement is used to determine how much to tighten the connection. Refer to Fig. 3 and Table 2 of the standard. Thread the pipe plug in by hand as far as possible, and, using a wrench, tighten the additional number of turns specified in Table 2 (column 15) of the standard.

For example:

- Use a wrench to tighten a 1-1/2 - 11-1/2 NPT pipe plug or a 2 - 11-1/2 NPT pipe plug an additional 3 turns beyond hand tight.

Be certain to use a good grade of pipe thread sealant to ensure a leak-proof connection.

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