



CRTi® Internal Grip Casing Running Tool

Volant’s CRTi® casing running tool is fully mechanical and designed for casing running or drilling with top drive equipped rigs to make up, break out, reciprocate, rotate, fill, circulate, and cement casing and liner strings, reducing non-productive time and associated costs. A simple rig-up and rig-down further increase operational efficiency.

- All new standard CRTi4-7.0 tools come with Low-Release Quad-Cams, which reduce the turns required to set and release the CRTi tool, and lower the release torque ratio. The Low-Release Cams are also available to upgrade legacy Quad-Cam CRTi tools.
- All new standard CRTi4-7.0 tools come with a High-Capacity Mandrel (CRTi4-7.0HC475), unless otherwise stated.
- The High-Flow Mandrel (CRTi4-7.0HF340) option provides a larger through hole and a modified casing seal assembly arrangement to support higher fluid flow rate requirements for Casing while Drilling (CwD) operations.
- The Slim Cage option enables all CRTi4-7.0 base tools to run 6.63 in. 24.0–28.0 ppf and 7.0 in. 38.0–42.7 ppf pipe sizes, while reducing the torque capacity to 35,000 ft.lb.
- The ActiveSET™ release upgrade, which must be installed with the vCAM™ latch mechanism, streamlines tool activation to a single-step process. The vCAM enables disengagement of the tool by either setting down and rotating to the left or by setting down directly into the latch from the break-out position.
- All configurations are mechanically activated in tension and both rotational directions by top-drive control using patented TAWG™ torque activated wedge grip technology.

Starting from the insertion diameter (cage OD) of the base tool, selectable sizes of integral jaws/dies are used to configure the CRTi tool to support gripping casing of increasing internal diameter. Through the use of a patented extended reach die structure, the gripping diameter can be further increased to include casing sizes much greater than that of the base tool.



Base Tool Characteristics¹

			CRTi4-7.0	CRTi4-7.0HF340	CRTi4-7.0HC475
CRTi Rated Load Capacity	Hoist	tn. (tonne)	420 (381)	340 (308)	475 (430)
	Torque	ft.lb. (N.m)	50,000 (67,700)	50,000 (67,700)	50,000 (67,700)
Set-down Load Capacity ²		tn. (tonne)	110 (99)	110 (99)	110 (99)
Typical Circulation Pressure Limit ³		psi (MPa)	5,000 (34.4)	5,000 (34.4)	5,000 (34.4)
Maximum Pressure End Load		tn. (tonne)	250 (226)	250 (226)	250 (226)
Base Tool Length		in. (mm)	59.0 (1,500) ⁴	74.0 (1,880) ⁵	59.0 (1,500) ⁴
Base Tool Weight ⁶		lb. (kg)	892 (405)	877 (398)	892 (405)
Die Range		in. (mm)	6.63 (168.4)–20.0 (508.0)	6.63 (168.4)–20.0 (508.0)	6.63 (168.4)–20.0 (508.0)
Diametrical Stroke		in. (mm)	0.61 (15.5)	0.61 (15.5)	0.61 (15.5)
Through-Hole		in. (mm)	1.5 (38)	2.25 (57)	1.5 (38)
Maximum Flow Rate ⁷		gpm (m ³ /min.)	660 (2.50)	1,460 (5.55)	660 (2.50)
Maximum Rotational Speed ⁸		RPM	Unlimited	Unlimited	Unlimited
Tool Joint			6% REG	6% REG	6% REG
Turns to Stroke Out ⁹			1.1 / 0.72	1.1 / 0.72	1.1 / 0.72

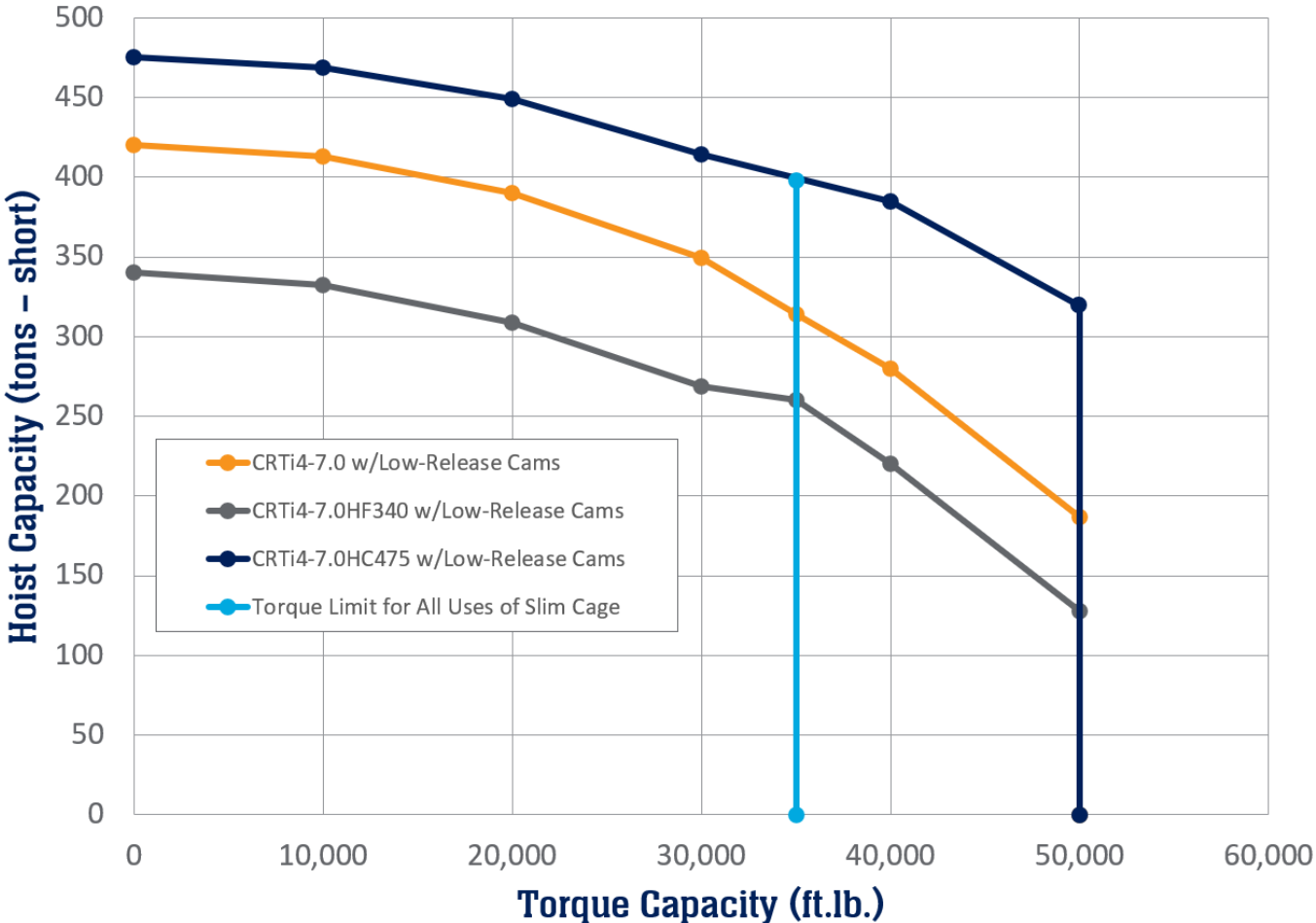


Casing Seal Assembly and Overall CRTi Tool Length

Casing Seal Description	Seal Type	Casing Size	CRTi4-7.0, CRTi4-7.0HC475 Overall Tool Length	CRTi4-7.0HF340 Overall Tool Length ⁵
		in. (mm)	in. (mm)	in. (mm)
Swivel Casing Seal	Packer Cup	6.63 (168.4) – 7.63 (193.8)	70.3 (1,790)	74.0 (1,880)
		8.63 (219.1) – 13.38 (339.7)	73.3 (1,865)	74.0 (1,880)
	WedgeSEAL™	13.38 (339.7) – 20.0 (508.0)	73.3 (1,865)	74.0 (1,880)

Combined Load Operation Curve

Please refer to the Base Tool Characteristics on page 1 of this Specification Summary for the numeric values such as CRTi Rated Load Capacity, Combined Load Large Hoist, and Combined Load High Torque illustrated in the graph below:





Tool Selection Guide

Step 1: Base Tool Selection The CRTi tool is available in a variety of dimensions and ratings. The Base Tool Characteristics table contains the ratings and overall dimensions of the tool. The required hoist, torque, set-down load capacity, and maximum flow rate must be lower than or equal to the base tool rating. If combined hoist and torque is required for the casing running job, the combined hoist and torque point must fall below or on the combined load operation curve.

Step 2: Die Selection Casing sizes and weights with drift diameter above 5.87 in. (149.1 mm) are available for this CRTi tool. Find the appropriate die for casing size and weight in the Die Sizes tables below. Some dies can run a range of casing weights.

Step 3: Die Hoist Capacity CRTi tool hoist rating is based on API Specification 8C; however, casing load limit is further constrained by local interaction of slip dies with casing, which must not exceed the efficiency indicated for individual slip die sizes to avoid excess deformation. The slip to casing interaction hoist limit (F_{die}) can be found by the following formula where efficiency is the slip to pipe body load efficiency number (listed in the Die Sizes tables below for every die) and F_{casing} is the casing hoist limit found in API TR 5C3.

$$F_{die} = \text{efficiency} \times F_{casing}$$

For example, from API TR 5C3 the pipe body yield for 9.63 in. x 40.0 ppf L80 (244.5 mm x 59.53 kg/m L80) casing is 916,000 lb. (415.5 tonne). The slip efficiency for slip die 81793 used to run this casing is 80%. Therefore, the die hoist capacity is:

$$80\% \times 916,000 \text{ lb.} = 732,800 \text{ lb.} = 366.4 \text{ tn.}$$

or

$$80\% \times 415.5 \text{ tonne} = 332.4 \text{ tonne}$$

In case the base tool hoist rating is smaller than the calculated die hoist limit, the base tool hoist rating will be limiting.

Step 4: Die Torque Capacity

$$T_{die} = K_{torque} \times W_{casing} \times \sigma Y_{casing}$$

Where T_{die} is the torque limit due to slip die/casing interaction,

K_{torque} is the torque factor,

W_{casing} is the desired casing weight in ppf (kg/m), and

σY_{casing} is the casing yield strength in psi (MPa)

If no value is provided, CRTi tool rating will be limiting for all standard casing grades. For example, for die 81793 to run 9.63 in. x 40.0 ppf L80 (244.5 mm x 59.53 kg/m L80) casing, the die torque capacity is:

$$0.02835 \text{ ft.lb./psi/ppf} \times 40.0 \text{ ppf} \times 80,000 \text{ psi} = 90,720 \text{ ft.lb.}$$

or

$$3.746 \text{ N.m/MPa/(kg/m)} \times 59.53 \text{ kg/m} \times 551.6 \text{ MPa} = 123,006 \text{ N.m}$$

Where the base tool torque capacity is lower than the die torque capacity, the CRTi tool is limited to base tool torque capacity.

Step 5: Effect of Circulation Pressure

CRTi tool hoist capacity must be reduced by the pressure end load during circulation. The hoist reduction ($F_{EndPressure}$) depends on circulation pressure (P), casing nominal ID (ID_{casing}), and CRTi tool through hole ($ID_{mandrel}$).

$$F_{EndPressure} = 0.79 \times P \times (ID_{casing}^2 - ID_{mandrel}^2)$$

For example, for circulation pressure of 1,000 psi (6.89 MPa) and casing nominal ID of 8.84 in. (224.5 mm) the hoist reduction is:

$$0.79 \times 1,000 \text{ psi} \times ((8.84 \text{ in.})^2 - (1.5 \text{ in.})^2) = 59,958 \text{ lb.} \sim 30.0 \text{ tn.}$$

or

$$0.79 \times 6.89 \text{ MPa} \times ((224.5 \text{ mm})^2 - (38.1 \text{ mm})^2) = 266,432 \text{ N} \sim 27.2 \text{ tonne.}$$

Therefore, the maximum hoist for the standard CRTi4-7.0 tool reduces to 420.0 – 30.0 = 390.0 tn. (353.8 tonne) or the maximum hoist for die 81793 (in step 3) must reduce to 366.4 – 30.0 = 336.4 tn. (305.2 tonne).

Please contact Volant for further information.



Summary of Standard Slip Die Sizes¹⁰

Die P/N	Nominal Pipe Size		CRTi4-7.0, CRTi4-7.0HF340, CRTi4-7.0HC475 Max. Pipe Weight ¹¹ (W _{casing})		CRTi4-7.0, CRTi4-7.0HF340 Min. Pipe Weight ¹² (W _{casing})		CRTi4-7.0HC475 Min. Pipe Weight ¹² (W _{casing})		Slip-to-Pipe-Body Load Efficiency	Torque Factor (K _{torque})	
	in.	mm	ppf	kg/m	ppf	kg/m	ppf	kg/m	% Fy	ft.lb./psi/ppf	N.m/MPa/(kg/m)
83000 ¹³	6.63	168.4	28.0	41.66	24.0	35.72	24.0	35.72	80%	-	-
81277	7.0	177.8	26.0	38.69	17.0	25.30	17.0	25.30	80%	0.03032	4.006
81508	7.0	177.8	35.0	52.09	26.0	38.69	29.0	43.15	80%	0.03102	4.098
83000 ¹³	7.0	177.8	42.7	63.54	38.0	56.55	38.0	56.55	80%	-	-
81884	7.63	193.7	33.7	50.15	24.0	35.72	26.4	39.28	80%	0.02592	3.425
83345	7.63	193.7	39.0	58.04	29.7	44.20	33.7	50.15	80%	0.02721	3.595
82750	7.63	193.7	55.3	82.30	51.2	76.19	51.2	76.19	80%	-	-
106454	8.63	219.1	32.0	47.62	24.0	35.72	24.0	35.72	80%	0.02604	3.441
81421	8.63	219.1	36.0	53.57	28.0	41.67	28.0	41.67	80%	0.02688	3.551
101755	8.63	219.1	44.0	65.48	36.0	53.57	40.0	59.52	80%	0.02267	2.995
83041	8.63	219.1	59.6	88.69	59.6	88.69	59.6	88.69	80%	-	-
81793	9.63	244.5	43.5	64.74	36.0	53.57	40.0	59.52	80%	0.02835	3.746
81420	9.63	244.5	53.5	79.62	47.0	69.94	53.5	79.62	80%	0.02513	3.320
82812	9.63	244.5	59.4	88.40	53.5	79.62	58.4	86.90	80%	-	-
82276	10.75	273.1	40.5	60.27	32.8	48.81	32.8	48.81	80%	0.02060	2.722
82275	10.75	273.1	51.0	75.90	45.5	67.71	45.5	67.71	80%	0.02179	2.879
102777	10.75	273.1	55.5	82.59	51.0	75.90	51.0	75.90	80%	0.02201	2.908
82910	10.75	273.1	60.7	90.33	55.5	82.59	55.5	82.59	80%	-	-
81255	10.75	273.1	65.7	97.77	60.7	90.33	60.7	90.33	80%	-	-
81494	10.75	273.1	73.2	108.93	71.1	105.81	71.1	105.81	80%	-	-
81138	10.75	273.1	79.2	117.86	79.2	117.86	79.2	117.86	80%	-	-
83096	10.75	273.1	109.0	162.21	109.0	162.21	109.0	162.21	80%	-	-
81495	11.75	298.5	60.0	89.29	54.0	80.36	54.0	80.36	80%	0.01932	2.552
81757	11.75	298.5	71.0	105.66	65.0	96.73	65.0	96.73	80%	-	-
100703	11.75	298.5	82.6	122.92	78.0	116.08	78.0	116.08	80%	-	-
82039	12.75	323.9	58.4	86.91	50.0	74.41	52.0	77.38	79%	0.01675	2.213
82168	13.38	339.7	54.5	81.10	48.0	71.43	48.0	71.43	80%	0.01705	2.252
81897	13.38	339.7	61.0	90.78	54.5	81.10	54.5	81.10	80%	0.01743	2.303
82164	13.38	339.7	68.0	101.20	61.0	90.78	68.0	101.20	80%	0.01773	2.342
81150	13.38	339.7	72.0	107.15	68.0	101.20	68.0	101.20	80%	0.01784	2.357
82588	13.38	339.7	77.0	114.59	72.0	107.15	72.0	107.15	80%	-	-
83154	13.38	339.7	86.0	127.98	85.0	126.49	85.0	126.49	80%	-	-



Summary of Standard Slip Die Sizes¹⁰ (continued)

Die P/N	Nominal Pipe Size		CRTi4-7.0, CRTi4-7.0HF340, CRTi4-7.0HC475 Max. Pipe Weight ¹¹ (W _{casing})		CRTi4-7.0, CRTi4-7.0HF340 Min. Pipe Weight ¹² (W _{casing})		CRTi4-7.0HC475 Min. Pipe Weight ¹² (W _{casing})		Slip-to-Pipe-Body Load Efficiency	Torque Factor (K _{torque})	
	in.	mm	ppf	kg/m	ppf	kg/m	ppf	kg/m		% Fy	ft.lb./psi/ppf
81431	16.0	406.4	65.0	96.73	65.0	96.73	65.0	96.73	72%	0.01452	1.918
81645	16.0	406.4	84.0	125.01	84.0	125.01	84.0	125.01	72%	0.01486	1.963
82100	16.0	406.4	97.0	144.35	96.0	142.86	97.0	144.34	71%	-	-
81758	16.0	406.4	109.0	162.21	109.0	162.21	109.0 ¹⁵	162.21 ¹⁵	72%	-	-
82532	16.77	426.0	77.0	114.59	73.3	109.08	75.5	112.34	67%	0.01388	1.834
106930	16.77	426.0	83.7	124.56	69.4	103.28	69.4	103.28	62%	0.01291	1.706
102675	17.0	431.8	77.5	115.33	77.5	115.33	77.5	115.33	64%	0.01332	1.760
81752	17.88	454.0	105.0	156.26	105.0	156.26	105.0 ¹⁵	156.26 ¹⁵	61%	-	-
100665	18.0	457.2	117.0	174.12	117.0	174.12	117.0 ¹⁵	174.12 ¹⁵	63%	-	-
82976	18.63	473.1	87.5	130.21	87.5	130.21	87.5	130.21	58%	0.01180	1.559
81566	18.63	473.1	97.7	145.39	97.7	145.39	97.7 ¹⁵	145.39 ¹⁵	63%	0.01273	1.682
82101	18.63	473.1	111.0	165.19	111.0	165.19	111.0 ¹⁵	165.19 ¹⁵	63%	-	-
82675	18.63	473.1	117.0	174.12	117.0	174.12	117.0 ¹⁵	174.12 ¹⁵	64%	-	-
82300	20.0	508.0	94.0	139.89	94.0	139.89	94.0	139.89	56%	0.01136	1.501
81759	20.0	508.0	106.5	158.49	106.5	158.49	106.5 ¹⁵	158.49 ¹⁵	57%	0.01157	1.528
81483	20.0	508.0	133.0 ¹⁴	197.93	133.0	197.93	133.0 ¹⁴	197.93	58%	-	-
101434	20.0	508.0	147.0	218.76	147.0	218.76	147.0 ¹⁵	218.76 ¹⁵	57%	-	-

- Characteristics are based on standard CRTi tool components and are independent of specific limitations of cage and accessories.
- Maximum allowable set-down load applied to the CRTi tool. Some set-down load may be reacted through the coupling. This rating does not consider bearing load limitations of the coupling. Minimum make-up torque requirements specified in running procedure 100027 must be followed to realize full set-down load capacity.
- CRTi tool circulation pressure capacity is generally governed by packer cup pressure capacity. Pressure capacity may be less than indicated if alternative seal arrangements are used.
- CRTi4-7.0 base tool length does not include casing seal assembly. To find overall CRTi tool length see *Casing Seal Assembly and Overall Tool Length* table.
- CRTi4-7.0HF340 base tool length does not change with casing seal assembly; base tool length is the same as overall tool length. Fixed Casing Seal is not available with this CRTi tool model.
- CRTi tool weight is approximate and represents 7.0 in. base tool configuration. Contact Volant sales at +1 780.784.7099 for further information on tool weight.
- Maximum flow rate is based on minimizing erosion rates when using typical fluids. Erosion rates may vary depending upon the fluid contents. Please inspect CRTi tool bore regularly.
- When rotating a casing/liner string during running/drilling operations, maximum rotational speeds are governed by top-drive or casing connection specific limits.
- Turns to Stoke Out is the rotational limit during CRTi tool make-up. (This may be exceeded in combined load scenarios.) The old style cams require 1.10 turns to stroke out and Low-Release Cams only require 0.72 turns to stroke out.
- Common die sizes shown. All API casing sizes and weights with drift diameter above 5.87 in. (149.1 mm) are available.
- Maximum pipe weight is defined by the API Specification 5CT drift diameter of the heaviest weight casing into which the CRTi tool assembled with the specified die set will fit.
- Indicated minimum pipe weight is based on the assumption that control of average pipe inside diameter over die grip interval does not allow pipe body area reduction less than 3.5% from nominal and additionally considers tool wear allowances, die penetration, casing deformation, and diametrical stroke.
- In order to run Integral Slips P/N 83000, the CRTi4-7.0 tool must be configured with Slim Cage P/N 82999 and Keeper P/N 83001. All uses of Slim Cage P/N 82999, which can also be used with all other CRTi4-7.0 Integral Slips and Dies, reduce the CRTi tool torque capacity to 35,000 ft.lb.
- Non-standard radial stroke limit for this casing weight only.
- Hoist limited to 420 tn. (381 tonne).

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