

CRTi™ Internal Grip Casing Running Tool

Volant's CRTi casing running tool is designed for casing running or drilling with top drive equipped rigs to makeup, breakout, reciprocate, rotate, fill, circulate and cement casing and liner strings, reducing non-productive time and associated costs. Casing drilling is achieved through the standard tool configuration, but if increased flow is desired, Volant's Highflow* option features a larger through hole for additional fluid flow. This tool is mechanically activated in tension and both rotational directions solely by top drive control using TAWG™ wedge grip technology.

This patented architecture puts control in the hands of the driller, reducing the need for third party support to run casing. Intuitive operations for pipe engagement and release closely emulate the familiar make and break steps used to run drill pipe – stab, rotate to the right to engage and reverse to disengage. Similarly, rig in and rig out steps are simple, intuitive and efficient.

Starting from the insertion diameter of the base tool (cage OD), selectable sizes of integral jaws/dies are used to configure the CRTi 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 the base tool.

Tool Model: CRTi4-7.0 Specification Summary

Base Tool Characteristics¹

CRTi Rated Load Capacity	Hoist	ton (tonne)	420 (381)
	Torque	ft.lbs (N.m)	50,000 (67,700)
Combined Load Large Hoist	Hoist	ton (tonne)	300 (272)
	Torque	ft.lbs (N.m)	30,000 (40,600)
Combined Load High Torque	Hoist	ton (tonne)	200 (181)
	Torque	ft.lbs (N.m)	50,000 (67,700)
Set-Down Load Capacity ²		ton (tonne)	110 (99)
Typical Circulation Pressure Limit ³		psi (MPa)	5,000 (34.4)
Maximum Pressure End Load		ton (tonne)	250 (226)
Base Tool Length ⁴		in (mm)	59.0 (1,500)
Diametrical Stroke		in (mm)	0.61 (15.0)
Through Hole		in (mm)	1.5 (38)
Maximum Flow Rate ⁵		gpm (m ³ /min)	660 (2.50)
Tool Joint			6.63 REG
Turns to Stroke Out			1.1

Tool Configuration with

Integral Slip Dies Extended Slip Dies Extended Reach Dies and Bumper Extension



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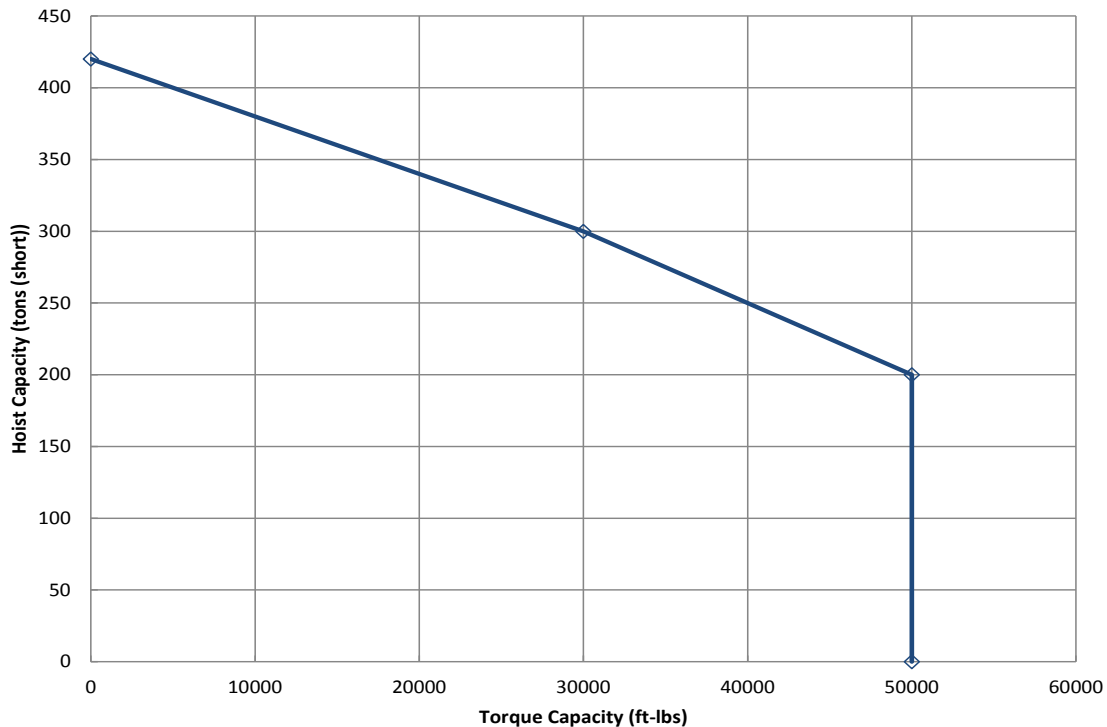
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Casing Seal Assembly and Tool Length⁴

Casing Seal Description	Seal Type	Casing Size in (mm)	Overall Tool Length in (mm)
Swivel Casing Seal	Packer Cup	7.0 (177.8) - 7.63 (193.7)	70.3 (1,790)
		8.63 (219.1) - 13.38 (339.7)	73.3 (1,865)
	Wedge Seal	13.38 (339.7) - 20.0 (508.0)	73.3 (1,865)

Combined Load Operation Curve

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



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Tool Selection Guide

Step 1: Base Tool Selection The CRTi 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 All API casing sizes and weights with drift diameter above 5.87 in (149.1 mm) are available for this tool. Find the appropriate die for casing size and weight in the die table below. Some dies can run a range of casing weights.

Step 3: Die Hoist Capacity Tool hoist rating is based on API Specifications 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 following table for every die) and F_{casing} is the casing hoist limit found in API Bulletin 5C2.

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

For example, from API 5C2 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 lbs (415.5 tonne). The slip efficiency for die 81793 used to run this casing is 80%. Therefore, the die hoist limit is:

$$80\% \times 916,000 \text{ lbs} = 732,800 \text{ lbs} = 366.4 \text{ ton}$$

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, 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 limit is:

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

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 tool is limited to base tool torque capacity.

Step 5: Effect of Circulation Pressure CRTi 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 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:

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

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 this tool reduces to 420.0 - 30.0 = 390.0 ton (353.8 tonne) or the maximum hoist for die 81793 (in step 3) must reduce to 366.4 - 30.0 = 336.4 ton (305.2 tonne).

Please contact Volant for further information.

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VOLANT Casing Running Tools (CRTi4-7.0)

Summary of Selected Slip Die Sizes⁶

Die P/N	Nominal Pipe Size		Max. Pipe Weight ⁷ (W _{casing})		Min. Pipe Weight ⁸ (W _{casing})		Die Curv. Diameter		Max. Tool Diameter		Approximate Tool Weight		Slip to Pipe Body Load Efficiency (% Fy)	Torque Factor (K _{torque})	
	(in)	(mm)	(ppf)	(kg/m)	(ppf)	(kg/m)	(in)	(mm)	(in)	(mm)	(lbs)	(kg)		(ft.lbs/psi/ ppf)	(N.m/MPa/ (kg/m))
81277	7.0	177.8	26.0	38.69	17.0	25.30	6.42	163.5	16.3	415	1,100	500	80%	0.03032	4.006
81508	7.0	177.8	35.0	52.09	26.0	38.69	6.16	156.5	16.3	415	1,100	500	80%	0.03102	4.098
83000	7.0	177.8	42.7	63.54	38.0	56.55	5.90	150.0	16.3	415	1,100	500	80%	-	-
81884	7.63	193.7	33.7	50.15	24.0	35.72	6.91	176.0	16.3	415	1,100	500	80%	0.02592	3.425
83345	7.63	193.7	39.0	58.04	29.7	44.20	6.78	172.5	16.3	415	1,100	500	80%	0.02721	3.595
82750	7.63	193.7	55.3	82.30	51.2	76.19	6.27	159.5	16.3	415	1,100	500	80%	-	-
81421	8.63	219.1	36.0	53.57	28.0	41.67	8.02	204.0	16.3	415	1,100	500	80%	0.02688	3.551
101755	8.63	219.1	44.0	65.48	36.0	53.57	7.78	198.0	16.3	415	1,100	500	80%	0.02267	3.007
83041	8.63	219.1	59.6	88.69	59.6	88.69	7.38	187.5	16.3	415	1,100	500	80%	-	-
81793	9.63	244.5	43.5	64.74	36.0	53.57	8.89	226.0	16.3	415	1,100	500	80%	0.02835	3.746
81420	9.63	244.5	53.5	79.62	47.0	69.94	8.67	220.5	16.3	415	1,100	500	80%	0.02513	3.320
82812	9.63	244.5	59.4	88.40	53.5	79.62	8.57	218.0	16.3	415	1,100	500	80%	-	-
82276	10.75	273.1	40.5	60.27	32.8	48.81	10.22	260.0	16.3	415	1,300	590	80%	0.02060	2.722
82275	10.75	273.1	51.0	75.90	45.5	67.71	10.02	255.0	16.3	415	1,300	590	80%	0.02179	2.879
82910	10.75	273.1	60.7	90.33	55.5	82.59	9.83	250.0	16.3	415	1,300	590	80%	-	-
81255	10.75	273.1	65.7	97.77	60.7	90.33	9.73	247.5	16.3	415	1,300	590	80%	-	-
81494	10.75	273.1	73.2	108.93	71.1	105.81	9.57	243.5	16.3	415	1,300	590	80%	-	-
81138	10.75	273.1	79.2	117.86	79.2	117.86	9.40	239.0	16.3	415	1,300	590	80%	-	-
83096	10.75	273.1	109.0	162.21	109.0	162.21	8.85	225.0	16.3	415	1,300	590	80%	-	-
81495	11.75	298.5	60.0	89.29	54.0	80.36	10.94	278.0	16.3	415	1,400	640	80%	0.01932	2.552
81757	11.75	298.5	71.0	105.66	65.0	96.73	10.75	273.5	16.3	415	1,400	640	80%	-	-
100703	11.75	298.5	82.6	122.92	78.0	116.08	10.54	268.0	16.3	415	1,400	640	80%	-	-
82039	12.75	323.9	58.4	86.91	50.0	74.41	12.03	306.0	16.3	415	1,650	750	79%	0.01675	2.213
82168	13.38	339.7	54.5	81.10	48.0	71.43	12.78	325.0	16.3	415	1,900	870	80%	0.01705	2.252
81897	13.38	339.7	61.0	90.78	54.5	81.10	12.68	322.5	16.3	415	1,900	870	80%	0.01743	2.303
82164	13.38	339.7	68.0	101.20	61.0	90.78	12.58	320.0	16.3	415	1,900	870	80%	0.01773	2.342
81150	13.38	339.7	72.0	107.15	68.0	101.20	12.52	318.5	16.3	415	1,900	870	80%	0.01784	2.357
82588	13.38	339.7	77.0	114.59	72.0	107.15	12.44	316.0	16.3	415	1,900	870	80%	-	-
83154	13.38	339.7	86.0	127.98	85.0	126.49	12.28	312.0	16.3	415	1,900	870	80%	-	-

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Summary of Selected Slip Die Sizes⁶ (continued)

Die P/N	Nominal Pipe Size		Max. Pipe Weight ⁷ (W _{casing})		Min. Pipe Weight ⁸ (W _{casing})		Die Curv. Diameter		Max. Tool Diameter		Approximate Tool Weight		Slip to Pipe Body Load Efficiency (% Fy)	Torque Factor (K _{torque})	
	(in)	(mm)	(ppf)	(kg/m)	(ppf)	(kg/m)	(in)	(mm)	(in)	(mm)	(lbs)	(kg)		(ft.lbs/psi/ppf)	(N.m/MPa/(kg/m))
81431	16.0	406.4	65.0	96.73	65.0	96.73	15.42	392.0	16.3	415	2,300	1,050	72%	0.01452	1.918
81645	16.0	406.4	84.0	125.01	84.0	125.01	15.18	386.0	16.3	415	2,300	1,050	72%	0.01486	1.963
82100	16.0	406.4	97.0	144.35	96.0	142.86	15.03	382.0	16.3	415	2,300	1,050	71%	-	-
81758	16.0	406.4	109.0	162.21	109.0	162.21	14.88	378.0	16.3	415	2,300	1,050	72%	-	-
82532	16.77	426.0	77.0	114.59	73.3	109.08	16.09	409.0	21.0	535	2,400	1,090	67%	0.01388	1.834
81752	17.88	454.0	105.0	156.26	105.0	156.26	16.96	431.0	21.0	535	2,450	1,120	61%	-	-
100665	18.0	457.2	117.0	174.12	117.0	174.12	16.94	430.5	21.0	535	2,450	1,120	63%	-	-
82976	18.63	473.1	87.5	130.21	87.5	130.21	17.95	456.0	21.0	535	2,600	1,180	58%	0.01180	1.559
81566	18.63	473.1	97.7	145.39	97.7	145.39	17.85	453.5	21.0	535	2,600	1,180	63%	0.01273	1.682
82101	18.63	473.1	111.0	165.19	111.0	165.19	17.71	450.0	21.0	535	2,600	1,180	63%	-	-
82675	18.63	473.1	117.0	174.12	117.0	174.12	17.63	448.0	21.0	535	2,600	1,180	64%	-	-
81880	18.63	473.1	139.0	206.85	139.0	206.85	17.39	442.0	21.0	535	2,600	1,180	64%	-	-
82300	20.0	508.0	94.0	139.89	94.0	139.89	19.31	490.5	21.0	535	2,800	1,280	56%	0.01136	1.501
81759	20.0	508.0	106.5	158.49	106.5	158.49	19.19	487.5	21.0	535	2,800	1,280	57%	0.01157	1.528
81483	20.0	508.0	133.0 ⁹	197.93	133.0 ⁹	197.93	18.92	481.0	21.0	535	2,800	1,280	58%	-	-
101434	20.0	508.0	147.0	218.76	147.0	218.76	18.78	477.5	21.0	535	2,800	1,280	57%	-	-

*For details and availability on the Highflow option contact Volant sales at +1 780.784.7099

1. Characteristics are based on standard tool components and are independent of specific limitations of cage and accessories.
2. Maximum allowable set-down load applied to the tool. Some set-down load may be reacted through the coupling. This rating does not take into account bearing load limitations of the coupling.
3. CRTi circulation pressure capacity is generally governed by packer cup pressure capacity. Pressure capacity may be less than indicated if alternative seal arrangements are used.
4. Base tool length does not include casing seal assembly. Overall tool length depends on the casing seal arrangement.
5. Maximum flow rate is based on minimizing erosion rates when using typical fluids. Erosion rates may vary depending upon the fluid contents. Please inspect tool bore regularly.
6. Common die sizes shown. All API casing sizes and weights with drift diameter above 5.87 in (149.1 mm) are available.
7. Maximum pipe weight is defined by the API Specification 5CT drift diameter of the heaviest weight casing into which the CRTi assembled with the specified die set will fit.
8. 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 takes into account tool wear allowances, die penetration, casing deformation and diametrical stroke.
9. Non-standard radial stroke limit for this casing weight only.

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