Casing Running Tools (CRTi3-7.0)

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.

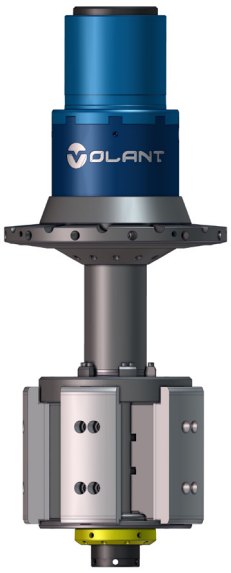
Tool Model: CRTi3-7.0 Specification Summary

Base Tool Characteristics[1]			Standard CwD	Highflow* CwD
CRTi Rated Load Capacity	Hoist	ton (tonne)	320 (290)[2]	238 (215)
	Torque	ft.lbs (N.m)	50,000 (67,700)	39,000 (52,800)
Combined Load Large Hoist	Hoist	ton (tonne)	250 (226)	201 (182)
	Torque	ft.lbs (N.m)	23,000 (31,100)	20,000 (27,100)
Combined Load High Torque	Hoist	ton (tonne)	100 (90)	119 (107)
	Torque	ft.lbs (N.m)	40,000 (54,200)	30,000 (40,600)
Set-Down Load Capacity[3]		ton (tonne)	100 (90)	100 (90)
Typical Circulation Pressure Limit[4]		psi (MPa)	5,000 (34.4)	5,000 (34.4)
Maximum Pressure End Load		ton (tonne)	250 (226)	190 (172)
Base Tool Length[5]		in (mm)	53.2 (1,355)	67.4 (1,715)
Diametrical Stroke		in (mm)	0.61 (15.5)	0.61 (15.5)
Through Hole		in (mm)	1.5 (40)	2.25 (57.5)
Maximum Flow Rate[6]		gpm (m^3/min)	650 (2.45)	1,460 (5.55)
Tool Joint			NC50 or 6.63 REG	NC50 or 6.63 REG
Turns to Stroke Out			1.48	1.48

Tool Configuration with

Integral Slip Dies

Extended Reach Dies and Bumper Extension



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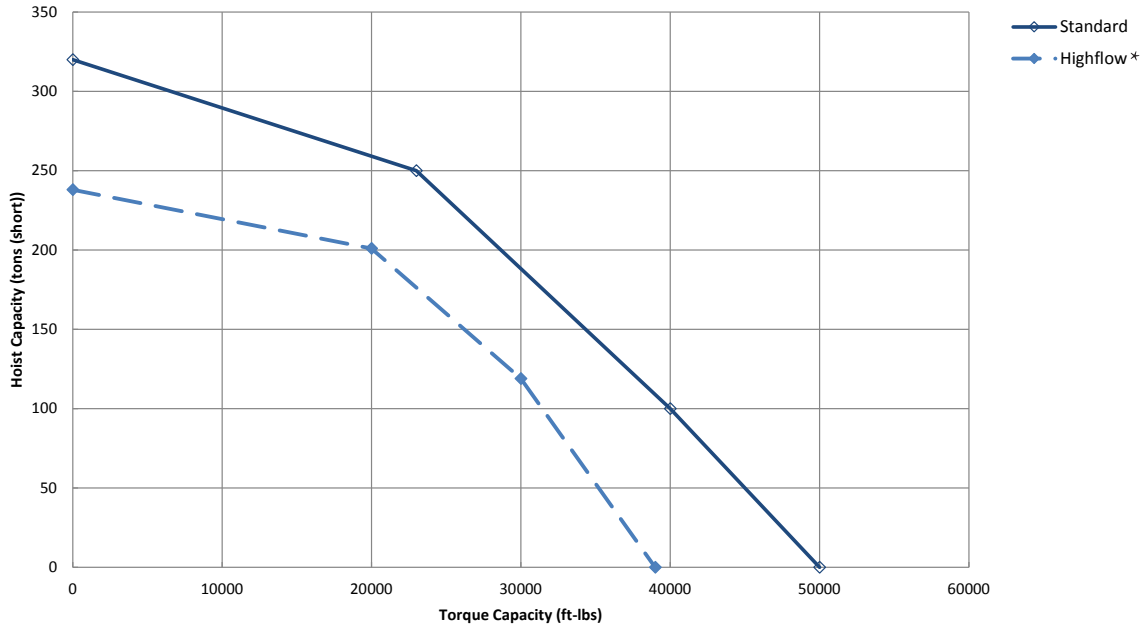
Tool Model: CRTi3-7.0 Specification Summary

Casing Seal Assembly and Tool Length[5]

Casing Seal Description	Seal Type	Casing Size in (mm)	Overall Tool Length in (mm)
Fixed Casing Seal	Packer Cup	7.0 (177.8)	62.5 (1,590)
		7.63 (193.7)	62.3 (1,585)
		8.63 (219.1)	62.5 (1,590)
		9.63 (244.5)	63.1 (1,605)
		10.75 (273.1)	63.5 (1,615)
		11.75 (298.5)	64.6 (1,645)
		12.75 (323.9) - 13.38 (339.7)	66.0 (1,680)
Swivel Casing Seal	Packer Cup	7.0 (177.8) - 7.63 (193.7)	64.5 (1,640)
		8.63 (219.1) - 13.38 (339.7)	67.5 (1,715)
	Wedge Seal	13.38 (339.7) - 20.0 (508.0)	62.6 (1,595)

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:



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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} = efficiency x 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 slip die 82157 used to run this casing is 75%. Therefore, the die hoist limit is:

75% × 916,000 lbs = 687,000 lbs = 343.5 ton

or

75% × 415.5 tonne = 311.6 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 82157 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:

0.01587 ft.lbs/psi/ppf × 40.0 ppf × 80,000 psi = 50,784 ft.lbs

or

2.097 N.m/MPa/(kg/m) × 59.53 kg/m × 551.6 MPa = 68,858 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 ($ID_{mandrel}$).

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

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 × 1,000 psi × ((8.84 in)^2 - (1.5 in)^2) = 59,958 lbs ~ 30.0 ton

or

0.79 × 6.89 MPa × ((224.5 mm)^2 - (38.1 mm)^2) = 266,432 N ~ 27.2 tonne.

Therefore, the maximum hoist for this tool reduces to 320.0 - 30.0 = 290.0 ton (262.8 tonne) or the maximum hoist for die 82157 (in step 3) must reduce to 343.5 - 30.0 = 313.5 ton (284.4 tonne).

Please contact Volant for further information.

Summary of Selected Die Sizes[7]

Die P/N	Nominal Pipe Size		Max. Pipe Weight[8] (W_{casing})		Min. Pipe Weight[9] (W_{casing})		Die Curv. Diameter		Max. Tool Diameter		Approximate Tool Weight		Slip to Pipe Body Load Efficiency	Torque Factor (K_{torque})	
	(in)	(mm)	(ppf)	(kg/m)	(ppf)	(kg/m)	(in)	(mm)	(in)	(mm)	(lbs)	(kg)	(% Fy)	(ft.lbs/psi/ ppf)	(N.m/MPa/ (kg/m))
80928	7.0	177.8	26.0	38.69	17.0	25.30	6.40	163.0	14.4	366	685	311	77%	0.01643	2.171
81062	7.0	177.8	35.0	52.09	26.0	38.69	6.16	156.5	14.4	366	685	311	80%	0.01899	2.509
80986	7.63	193.7	33.7	50.15	24.0	35.72	6.93	176.5	14.4	366	900	409	71%	0.01512	1.997
82279	7.63	193.7	39.0	58.04	29.7	44.20	6.76	172.0	14.4	366	900	409	76%	0.01632	2.156
80987	8.63	219.1	32.0	47.62	24.0	35.72	7.80	198.5	14.4	366	910	413	80%	0.01744	2.304
80824	8.63	219.1	36.0	53.57	28.0	41.67	7.70	196.0	14.4	366	910	413	80%	0.01744	2.304
82118	9.63	244.5	36.0	53.57	32.3	48.07	8.78	223.5	14.4	366	920	418	73%	0.0153	2.021
82749	9.63	244.5	40.0	59.53	32.3	48.07	8.68	220.5	14.4	366	920	418	73%	0.01235	1.631
80825	9.63	244.5	43.5	64.74	36.0	53.57	8.60	218.5	14.4	366	920	418	74%	0.01561	2.062
82157	9.63	244.5	47.0	69.94	40.0	59.53	8.53	217.0	14.4	366	920	418	75%	0.01587	2.097
80988	9.63	244.5	53.5	79.62	47.0	69.94	8.39	213.5	14.4	366	920	418	76%	0.01628	2.151
82021	10.75	273.1	40.5	60.27	32.8	48.81	9.90	251.5	14.4	366	950	431	63%	0.01296	1.712
81323	10.75	273.1	51.0	75.90	45.5	67.71	9.70	246.5	14.4	366	950	431	66%	0.01386	1.831
81085	10.75	273.1	60.7	90.33	55.5	82.59	9.51	242.0	14.4	366	950	431	68%	0.01429	1.888
81955	11.75	298.5	47.0	69.94	42.0	62.50	10.84	275.5	14.4	366	950	431	55%	0.01141	1.507
80833	11.75	298.5	54.0	80.36	47.0	69.94	10.72	272.5	14.4	366	950	431	56%	0.01171	1.547
82070	11.75	298.5	60.7	90.33	54.5	81.10	10.62	270.0	14.4	366	950	431	58%	0.01198	1.583
83052	12.75	323.9	52.0	77.38	47.1	70.09	11.81	300.0	14.4	366	960	436	51%	0.01088	1.437
83002	12.75	323.9	58.4	86.91	50.0	74.41	11.74	298.5	14.4	366	960	436	51%	0.01098	1.450
82327	13.38	339.7	54.5	81.10	48.0	71.43	12.48	317.0	14.4	366	960	436	45%	0.00934	1.234
80828	13.38	339.7	61.0	90.78	54.5	81.10	12.36	314.0	14.4	366	960	436	47%	0.00977	1.291
81064	13.38	339.7	72.0	107.15	68.0	101.20	12.19	310.0	14.4	366	960	436	49%	0.01033	1.364

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Summary of Selected Die Sizes[7] *(continued)*

Die P/N	Nominal Pipe Size		Max. Pipe Weight[8] (W_{casing})		Min. Pipe Weight[9] (W_{casing})		Die Curv. Diameter		Max. Tool Diameter		Approximate Tool Weight		Slip to Pipe Body Load Efficiency	Torque Factor (K_{torque})	
	(in)	(mm)	(ppf)	(kg/m)	(ppf)	(kg/m)	(in)	(mm)	(in)	(mm)	(lbs)	(kg)	(% Fy)	(ft.lbs/psi/ ppf)	(N.m/MPa/ (kg/m))
81504	15.0	381.0	92.5	137.66	92.5	137.66	13.65	347.0	21.0	535	1,040	480	45%	0.00949	1.254
80826	16.0	406.4	65.0	96.73	65.0	96.73	15.06	383.0	21.0	535	1,040	480	25%	0.00545	0.720
82440	16.0	406.4	75.0	111.61	75.0	111.61	14.95	380.0	21.0	535	1,040	480	27%	0.00593	0.783
100078	16.0	406.4	84.0	125.01	84.0	125.01	14.82	376.5	22.0	560	1,040	480	29%	0.0063	0.832
100079	16.0	406.4	109.0	162.21	109.0	162.21	14.51	369.0	23.0	585	1,040	480	33%	0.00715	0.944
83003	16.77	426.0	77.0	114.59	73.3	109.08	15.71	399.5	24.0	610	1,050	480	24%	0.00568	0.750
80832	18.63	473.1	87.5	130.21	87.5	130.21	17.57	446.5	21.0	535	1,060	490	22%	0.00489	0.646
81292	18.63	473.1	97.7	145.39	97.7	145.39	17.47	444.0	21.0	535	1,060	490	25%	0.00659	0.870
82956	18.63	473.1	106.0	157.75	106.0	157.75	17.36	441.0	21.0	535	1,060	490	26%	0.00683	0.902
81293	18.63	473.1	111.0	165.19	111.0	165.19	17.34	440.5	21.0	535	1,060	490	27%	0.00669	0.884
101407	18.63	473.1	115.0	171.14	115.0	171.14	17.27	439.0	21.0	535	1,060	490	25%	0.00567	0.749
81991	20.0	508.0	94.0	139.89	94.0	139.89	19.22	488.5	21.0	535	1,250	570	27%	0.00591	0.780
81799	20.0	508.0	111.0	165.19	111.0	165.19	19.22	488.5	21.0	535	1,250	570	27%	0.00603	0.796

*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. Higher Rated Load Capacity is available. For details and availability contact Volant sales at +1 780.784.7099
3. 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.
4. 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.
5. Base tool length does not include casing seal assembly. Overall tool length depends on the casing seal arrangement.
6. 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.
7. Common die sizes shown. All API casing sizes and weights with drift diameter above 5.87 in (149.1 mm) are available.
8. 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.
9. 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.

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