Casing Running Tool with Internal Grip (CRTi™)

Volant's CRTi is designed for casing drilling or running 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. This tool is mechanically activated in tension and both rotational directions solely by top drive control using TAWG™ (Torque Activated Wedge Grip) technology.

This patented architecture puts control in the hands of the driller, reducing the need for third party support to run casing. Simple intuitive operating steps 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.

Tool Model: CRTi2-4.5
Specification Summary

Base Tool Characteristics[1]

CRTi Rated Load Capacity	Hoist	ton (tonne)	120 (109)
	Torque	ft.lbs (N.m)	13,000 (17,626)
Combined Load Large Hoist	Hoist	ton (tonne)	100 (91)
	Torque	ft.lbs (N.m)	6,000 (8,135)
Combined Load High Torque	Hoist	ton (tonne)	50 (45)
	Torque	ft.lbs (N.m)	10,000 (13,558)
Set-Down Load Capacity[2]		ton (tonne)	70 (64)
Typical Circulation Pressure Limit[3]		psi (MPa)	5,000 (34)
Maximum Pressure End Load		ton (tonne)	50 (45)
Base Tool Length[4]		in (mm)	41.1 (1,044)
Diametrical Stroke		in (mm)	0.47 (11.9)
Through Hole		in (mm)	1.0 (25.4)
Maximum Flow Rate[5]		gpm (m^3/min)	290 (1.1)
Tool Joint			NC50
Turns to Stroke Out			1.78

Cage Specific Characteristics

Cage P/N	Torque Capacity ft.lbs (N.m)	OD in (mm)
81325	10,000 (13,558)	3.79 (96.3)
80939	13,000 (17,626)	3.87 (98.3)

Tool Configuration with Integral Slip Dies

Give us a problem. Or just drop us a line if you want to know more.

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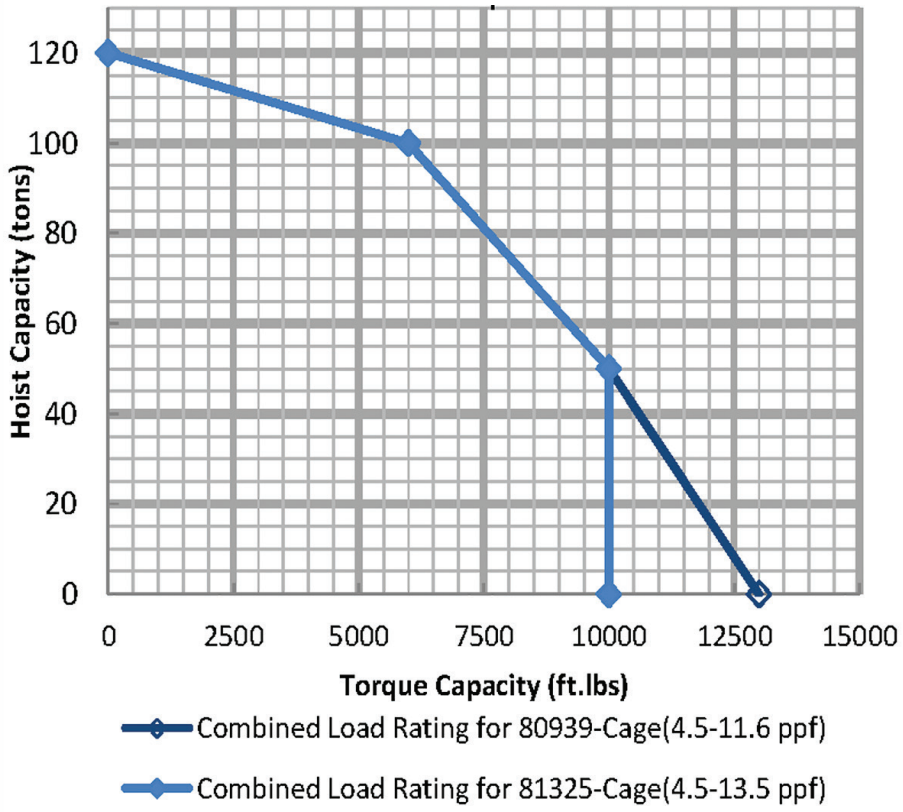
Tool Model: CRTi2-4.5 Specification Summary

Casing Seal Assembly and Tool Length[4]

Casing Seal Description	Seal Type	Casing Size in (mm)	Overall Tool Length in (mm)
Fixed Casing Seal	Packer Cup	4.5 (114.3)	48.3 (1,228)
		5.5 (139.7)	49.4 (1,254)
Swivel Casing Seal	Packer Cup	4.5 (114.3)	49.2 (1,248)
		5.0 (127.0)	49.2 (1,248)
		5.5 (139.7)	49.2 (1,248)

Combined Load Operation Curve

Please refer to the Base Tool Characteristics table on page 1 of this Specification Summary for numeric values (CRTi Rated Load Capacity, Combined Load Large Hoist, Combined Load High Torque) illustrated in the graph below.



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: Cage Selection The torque capacity of the CRTi may be limited by torque capacity of the cage. Some cages are designed to run casing with smaller drift. The cage with higher torque capacity is preferable unless the drift of the casing is smaller than the cage OD.

Step 3: Die Selection Refer to the die table below with the selected cage in the heading. All API casing sizes and weights with drift diameter above 3.79 in (96.3 mm) are available for this tool. Find the appropriate die for casing size and weight. Some dies can run a range of casing weights.

Step 4: Die Hoist Capacity 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 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 4.5 in x 11.6 ppf L80 (114.3 mm x 17.26 kg/m L80) casing is 267,000 lbs (121.1 tonne). The slip efficiency for die 80957 used to run this casing is 80%. Therefore, the die hoist limit is:

80% × 267,000 lbs = 231,600 lbs = 106.8 ton

or

80% × 121.1 tonne = 96.8 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 5: Die Torque Capacity Torque capacity may be limited by slip die/casing interaction. Where torque factors (K_{torque}) are provided, the slip die/casing interaction torque limit (T_{die}) is:

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

Where 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 80957 to run 4.5 in x 11.6 ppf L80 (114.3 mm x 17.26 kg/m L80) casing, the die torque limit is:

0.01336 ft.lbs/psi/ppf × 11.6 ppf × 80,000 psi = 12,398 ft.lbs

or

1765 N.m/MPa/(kg/m) × 17.26 kg/m × 551.6 MPa = 16,803 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 6: 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 500 psi (3.4 MPa) and casing nominal ID of 3.92 in (99.6 mm) the hoist reduction is:

0.79 × 500 psi × ((3.92 in)^2- (1.0 in)^2) = 5,675 lbs ~ 2.8 ton

or

0.79 × 3.4 MPa × ((99.6 mm)^2- (25.4 mm)^2) = 24,913 N ~ 2.5 tonne

Therefore, the maximum hoist for this tool reduces to 120.0 - 2.8 = 117.2 ton (106.5 tonne) or the maximum hoist for die 80957 (in step 4) must reduce to 106.8 - 2.8 = 104.0 ton (94.3 tonne).

Please contact Volant for further information.

Summary of Selected Die Sizes Run with Cage 81325[6]

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	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))
80957	4.5	114.3	13.5	20.09	9.5	14.14	4.08	103.7	11.0	279	320	145	80%	0.01336	1.765
82000	5.0	127.0	18.0	26.79	15.0	22.32	4.44	112.8	11.0	279	350	159	80%	0.01248	1.649
82734	5.0	127.0	21.4	31.85	18.0	26.79	4.28	108.7	11.0	279	350	159	80%	0.01315	1.738
80980	5.5	139.7	17.0	25.3	14.0	20.83	5.06	128.6	11.0	279	350	159	70%	0.0099	1.308
81182	5.5	139.7	23.0	34.23	20.0	29.76	4.84	122.9	11.0	279	350	159	78%	0.01125	1.487
82823	5.5	139.7	26.8	39.88	23.0	34.23	4.76	120.9	11.0	279	350	159	80%	-	-

Summary of Selected Die Sizes Run with Cage 80939[6]

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	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))
80957	4.5	114.3	11.6	17.26	9.5	14.14	4.08	103.7	11.0	279	320	145	80%	0.01336	1.765
82000	5.0	127.0	18.0	26.79	15.0	22.32	4.44	112.8	11.0	279	350	159	80%	0.01248	1.649
82734	5.0	127.0	21.4	31.85	18.0	26.79	4.28	108.7	11.0	279	350	159	80%	0.01315	1.738
80980	5.5	139.7	17.0	25.3	14.0	20.83	5.06	128.6	11.0	279	350	159	70%	0.0099	1.308
81182	5.5	139.7	23.0	34.23	20.0	29.76	4.84	122.9	11.0	279	350	159	78%	0.01125	1.487
82823	5.5	139.7	26.8	39.88	23.0	34.23	4.76	120.9	11.0	279	350	159	80%	-	-

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 based on fluid contents. Please inspect tool bore regularly.

6 Common die sizes shown. All API casing sizes and weights with drift diameter above 3.79 in (96.27 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.