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 makeup, breakout, reciprocate, rotate, fill, circulate and cement casing and liner strings, reducing non-productive time and associated costs. The standard CRTi tool uses intuitive operations for pipe engagement and release – stab, rotate to the right to engage and reverse to disengage. A simple rig-up and rig-down further increases operational efficiency. This tool is mechanically activated in tension and both rotational directions by top drive control using TAWG™ wedge grip.

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.

Base Tool Characteristics[1]

			CRTi2-4.5
CRTi Rated Load Capacity	Hoist	ton (tonne)	120 (108)
	Torque	ft.lbs (N.m)	13,000 (17,600)
Set-Down Load Capacity[2]		ton (tonne)	70 (63)
Typical Circulation Pressure Limit[3]		psi (MPa)	5,000 (34.4)
Maximum Pressure End Load		ton (tonne)	50 (45)
Base Tool Length[4]		in. (mm)	41.1 (1,045)
Base Tool Weight[5]		lbs (kg)	337 (153)
Integral Slip Range		in. (mm)	4.5 (114.3) – 5.5 (139.7)
Diametrical Stroke		in. (mm)	0.47 (11.5)
Through Hole		in. (mm)	1.0 (25.4)
Maximum Flow Rate[6]		gpm (m^3/min)	290 (1.10)
Maximum Rotational Speed[7]		RPM	Unlimited
Tool Joint			NC50
Turns to Stroke Out			1.78

Cage Characteristics

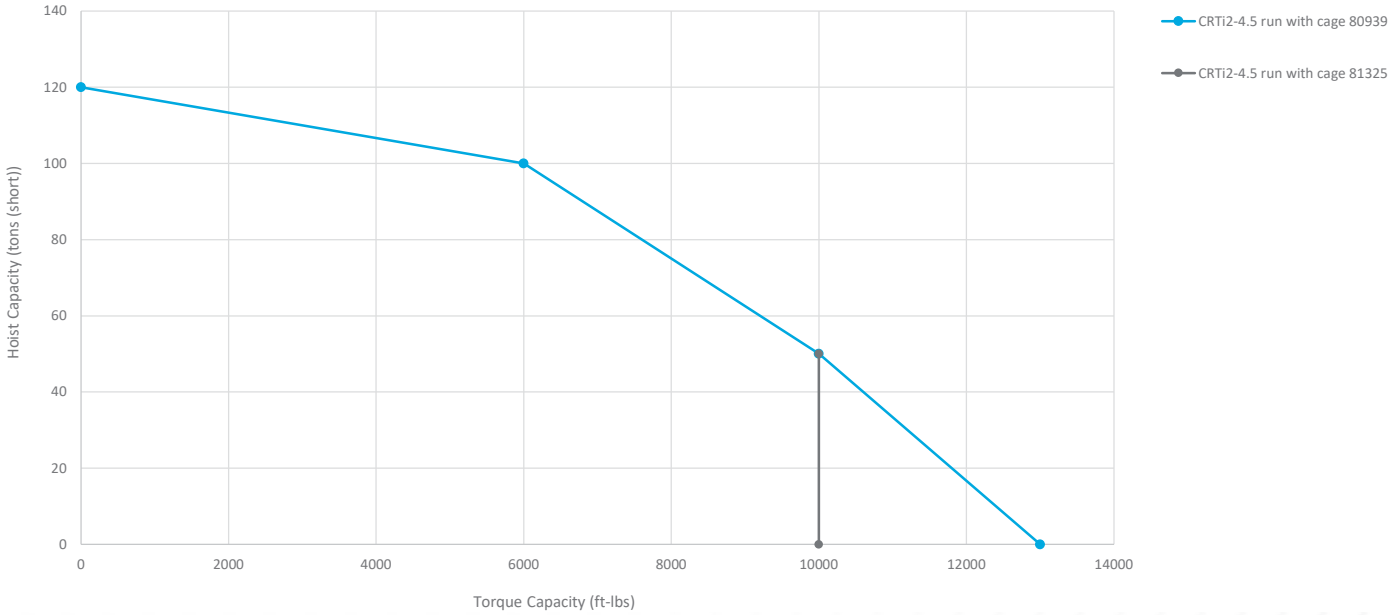
Cage P/N	Torque Capacity ft.lbs (N.m)	OD in. (mm)
81325	10,000 (13,500)	3.79 (96.3)
80939	13,000 (17,600)	3.87 (98.3)

Casing Seal Assembly and Overall Tool Length

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 (1,230)
		5.5 (139.7)	49.4 (1,255)
Swivel Casing Seal	Packer Cup	4.5 (114.3)- 5.5 (139.7)	49.2 (1,250)

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 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 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 (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 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 slip die 80957 used to run this casing is 80%. Therefore, the die hoist limit is:

80% × 267,000 lbs = 213,600 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

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

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 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

1.765 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 the CRTi2-4.5 tool reduces to 120.0 - 2.8 = 117.2 ton (106.3 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 Integral Slip Sizes Run with Cage 81325[8]

Die P/N	Nominal Pipe Size		Max. Pipe Weight[9] (W_{casing})		Min. Pipe Weight[10] (W_{casing})		Slip to Pipe Body Load Efficiency	Torque Factor (K_{torque})	
	(in.)	(mm)	(ppf)	(kg/m)	(ppf)	(kg/m)	(% Fy)	(ft.lbs/psi/ppf)	(N.m/MPa/(kg/m))
80957[11]	4.5	114.3	13.5	20.09	9.5	14.14	80%	0.01336	1.765
80957	4.5	114.3	11.6	17.26	9.5	14.14	80%	0.01336	1.765
82000	5.0	127.0	18.0	26.79	15.0	22.32	80%	0.01248	1.649
82734	5.0	127.0	21.4	31.85	18.0	26.79	80%	0.01315	1.737
80980	5.5	139.7	17.0	25.30	14.0	20.83	70%	0.0099	1.308
81182	5.5	139.7	23.0	34.23	20.0	29.76	78%	0.01125	1.486
82823	5.5	139.7	26.8	39.88	23.0	34.23	80%	-	-

Summary of Selected Integral Slip Sizes Run with Cage 80939[8]

Die P/N	Nominal Pipe Size		Max. Pipe Weight[9] (W_{casing})		Min. Pipe Weight[10] (W_{casing})		Slip to Pipe Body Load Efficiency	Torque Factor (K_{torque})	
	(in.)	(mm)	(ppf)	(kg/m)	(ppf)	(kg/m)	(% Fy)	(ft.lbs/psi/ppf)	(N.m/MPa/(kg/m))
80957	4.5	114.3	11.6	17.26	9.5	14.14	80%	0.01336	1.765
82000	5.0	127.0	18.0	26.79	15.0	22.32	80%	0.01248	1.649
82734	5.0	127.0	21.4	31.85	18.0	26.79	80%	0.01315	1.737
80980	5.5	139.7	17.0	25.30	14.0	20.83	70%	0.0099	1.308
81182	5.5	139.7	23.0	34.23	20.0	29.76	78%	0.01125	1.486
82823	5.5	139.7	26.8	39.88	23.0	34.23	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. To find overall tool length see ***Casing Seal Assembly and Overall Tool Length*** table.
5. Tool weight is approximate and represents 4.5 in. base tool configuration. Contact Volant sales for further information on tool weight at +1 780.784.7099
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. When rotating a casing/liner string during running/drilling operations, maximum rotational speeds are governed by top drive or casing connection specific limits.
8. Common integral slip sizes shown. All API casing sizes and weights with drift diameter above 3.79 in (96.27 mm) are available.
9. 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 integral slip set will fit.
10. Indicated minimum pipe weight is based on the assumption that control of average pipe inside diameter over integral slip grip interval does not allow pipe body area reduction less than 3.5% from nominal and additionally takes into account tool wear allowances, integral slip penetration, casing deformation and diametrical stroke.
11. CRTi1,2-4.5 Cage (P/N: 81325) when run in conjunction with Integral Slips (P/N: 80957) enabling running 4.5" 13.5ppf casing, with a reduced torque capacity of 10,000 ft.lbs. All other CRTi1,2-4.5 Integral Slips can be run with Cage (P/N: 81325) with a reduced torque capacity of 10,000 ft.lbs.