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 equipped with low-release cams to reduce the turns to stroke out needed to set and release the tool. This tool is mechanically activated in tension and both rotational directions by top drive control using patented TAWG™ torque activated 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]

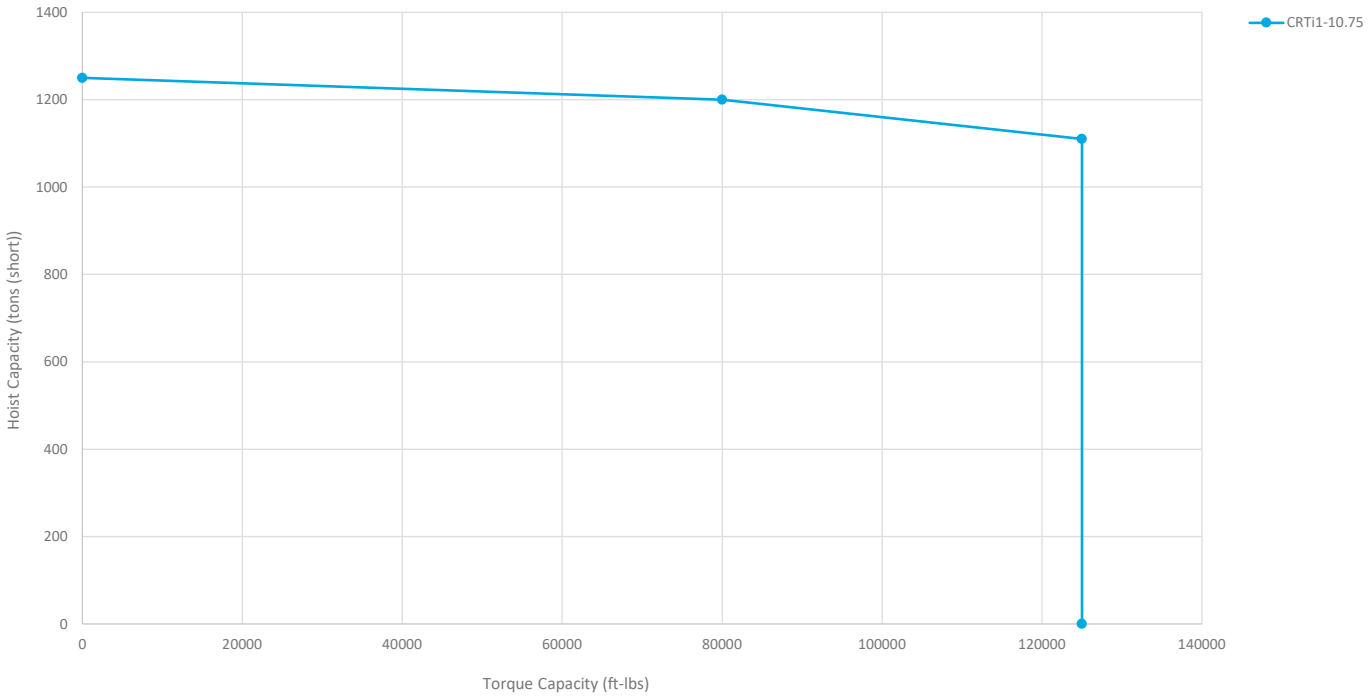
			CRTil-10.75
CRTi Rated Load Capacity	Hoist	ton (tonne)	1,250 (1,133)
	Torque	ft.lbs (N.m)	125,000 (169,400)
Set-Down Load Capacity[2]		ton (tonne)	100 (90)
Typical Circulation Pressure Limit[3]		psi (MPa)	5,000 (34.4)
Maximum Pressure End Load		ton (tonne)	750 (680)
Base Tool Length[4]		in. (mm)	80.4 (2,045)
Base Tool Weight[5]		lbs (kg)	1,951 (890)
Die Range[6]		in. (mm)	10.75 (273.0) – 36.0 (914.4)
Diametrical Stroke		in. (mm)	1.0 (25.4)
Through Hole		in. (mm)	2.25 (57.2)
Maximum Flow Rate[7]		gpm (m^3/min)	1,450 (5.50)
Maximum Rotational Speed[8]		RPM	Unlimited
Tool Joint			8-⅝ REG
Turns to Stroke Out			0.62

Casing Seal Assembly and Overall Tool Length

Casing Seal Description	Seal Type	Casing Size in. (mm)	Overall Tool Length in. (mm)
Swivel Casing Seal	Packer Cup	10.75 (273.1) - 13.38 (339.7)	93.4 (2,372)
	Wedge Seal™	13.38 (339.7) - 36.0 (914.4)	89.8 (2,285)

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: Die Selection

All API casing sizes and weights with drift diameter above 9.13 in. (231.8 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 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 (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 16.0 in. x 84.0 ppf J55 (406.4 mm x 125.0 kg/m J55) casing is 1,326,000 lbs (601.4 tonne). The slip efficiency for slip die 104422 used to run this casing is 80%. Therefore, the die hoist limit is:

80% × 1,326,000 lbs = 1,060,800 lbs = 530.4 ton

or

80% × 601.4 tonne = 481.1 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 104422 to run 16.0 in. x 84.0 ppf J55 (406.4 mm x 125.0 kg/m J55) casing, the die torque limit is:

0.03414 ft.lbs/psi/ppf × 84.0 ppf × 55,000 psi = 157,727 ft.lbs

or

4.5112 N.m/MPa/(kg/m) × 125.0 kg/m × 379.2 MPa = 213,831 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 500 psi (3.4 MPa) and casing nominal ID of 15.01 in. (381.3 mm) the hoist reduction is:

0.79 × 500 psi × ((15.01 in.)² - (2.25 in.)²) = 86,994 lbs ~ 43.5 ton

or

0.79 × 3.4 MPa × ((381.3 mm)² - (57.15 mm)²) = 387,358 N ~ 39.5 tonne

Therefore, the maximum hoist for the CRTi1-10.75 tool reduces to 1,250.0- 43.58 = 1,206.5 ton (1,094.6 tonne) or the maximum hoist for die 104422 (in step 3) must reduce to 530.4 - 43.5 = 486.9 ton (441.7 tonne).

Please contact Volant for further information.

Summary of Selected Die Size[9]

Die P/N	Nominal Pipe Size		Max. Pipe Weight[10] (W_{casing})		Min. Pipe Weight[11] (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))
104432	10.75	273.1	55.5	82.59	32.8	48.81	80%	0.04426	5.849
105100	10.75	273.1	79.2	117.86	55.5	82.59	80%	0.05046	6.668
105136	11.75	298.5	71.0	105.66	42.0	62.50	80%	0.03979	5.258
104434	11.75	298.5	94.0	139.89	65.0	96.73	80%	0.04495	5.940
104498	12.75	323.9	58.4	86.91	44.4	66.07	80%	0.04423	5.845
101955	13.38	339.7	72.0	107.15	48.0	71.43	80%	0.0393	5.193
104422	16.0	406.4	97.0	144.35	65.0	96.73	80%	0.03414	4.512
104542	16.0	406.4	129.5	192.72	97.0	144.35	80%	-	-
104423	16.77	426.0	83.7	124.56	69.4	103.28	80%	0.03565	4.711
104424	18.0	457.2	129.0	191.97	117.0	174.12	80%	-	-
104421	18.63	473.1	117.0	174.12	87.5	130.21	80%	0.03237	4.277
104425	18.63	473.1	139.0	206.85	106.0	157.75	80%	-	-
104426	20.0	508.0	129.3	192.42	94.0	139.89	80%	0.02991	3.952
104494	20.0	508.0	147.0	218.76	118.0	175.60	80%	-	-
104427	20.0	508.0	166.6	247.93	147.0	218.76	80%	-	-
104428	22.0	558.8	184.5	274.57	180.0	267.87	78%	-	-
104429	22.0	558.8	228.8	340.49	228.8	340.49	79%	-	-
102736	24.0	609.6	201.0	299.12	171.3	254.92	66%	-	-
104430	26.0	660.4	219.0	325.91	201.3	299.57	65%	-	-
104431	28.0	711.2	222.7	331.41	222.7	331.41	62%	-	-
105778	30.0	762.0	196.3	292.13	196.1	291.83	48%	-	-
105177	30.0	762.0	239.0	355.67	196.3	292.13	46%	-	-
105182	36.0	914.4	373.8	556.28	373.8	556.28	49%	-	-
105777	36.0	914.4	557.0	828.91	557.0	828.91	50%	-	-
105779	36.0	914.4	731.9	1,089.19	731.9	1,089.19	52%	-	-

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. Minimum makeup torque requirements specified in running procedure 100027 must be followed to realize full set-down load capacity.
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 10.75 in. base tool configuration. Contact Volant sales for further information on tool weight at +1 780.784.7099
6. CRTi1-10.75 tool can run up to 38 in. casing size. Contact Volant sales for availability at +1 780.784.7099.
7. 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.
8. When rotating a casing/liner string during running/drilling operations, maximum rotational speeds are governed by top drive or casing connection specific limits.
9. Common die sizes shown. All API casing sizes and weights with drift diameter above 9.13 in. (231.8 mm) are available.
10. 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.
11. 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.