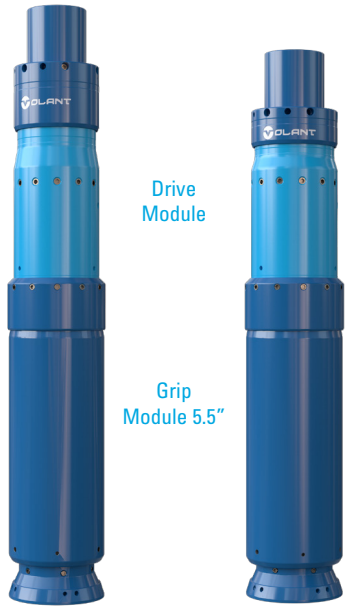
CRTe® External Grip Casing Running Tool

Volant's CRTe® 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 CRTe 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.

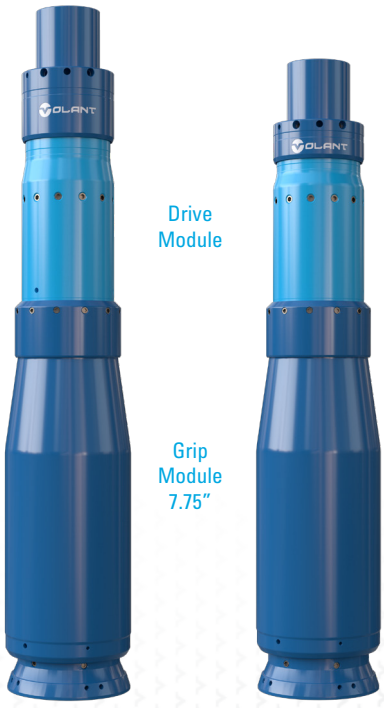
This patented architecture puts control in the hands of the driller, reducing the need for third party support to run casing. Intuitive operations for pipe engagement and release closely emulate the familiar make and break steps used to run drill pipe – stab, rotate to the right to engage and reverse to disengage. Similarly, rig-in and rig-out steps are simple, intuitive and efficient. This tool is mechanically activated in tension and both rotational directions solely by top drive control using TAWG™ wedge grip.

Starting from the base bell diameter, selectable sizes of jaws/dies are used to configure the CRTe to support gripping casing of decreasing external diameter.

CRTe-1.0 with Grip Module 5.5"
CRTe-1.0GM5.5



CRTe-1.0 with Grip Module 7.75"
CRTe-1.0GM7.75



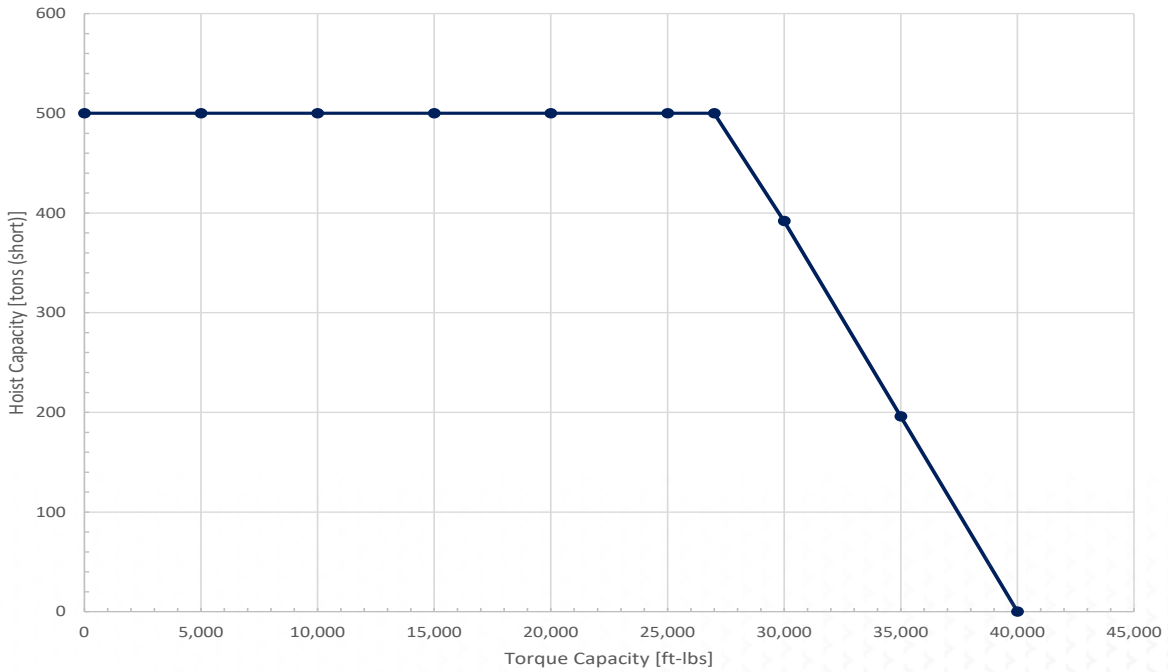
Drive Module

CRTe Rated Load Capacity	Hoist[1,2]	ton (tonne)	500 (453)
	Torque[3]	ft.lbs (N.m)	40,000 (54,200)
Combined Load Capacity	Refer to Combined Load Operating Curve on page 2		
Set-Down Load Capacity[4]		ton (tonne)	200 (181)
Typical Circulation Pressure Limit[5,6]		psi (MPa)	5,000 (34.4)
Maximum Pressure End Load[6]		ton (tonne)	150 (136)
Maximum Pressure End Load with Retractable Stinger[6]		ton (tonne)	50 (45)
Float Length (Float Tool Only)		in. (mm)	6.0 (152.4)
Through Hole		in. (mm)	1.25 (32.0)
Maximum Flow Rate[7]		gpm (m^3/min)	449 (1.70)
Maximum Rotational Speed[8]		RPM	Unlimited
Tool Joint			NC50
Turns to Stroke Out			1.75

Configuration Characteristics[9]

		CRTe-1.0GM5.5		CRTe-1.0GM7.75	
		Float	Non-Float	Float	Non-Float
Overall Tool Length with Retractable Stinger	in. (mm)	87.6 (2,226)	75.6 (1,921)	95.5 (2,426)	83.5 (2,121)
Overall Tool Length with Fixed Mandrel Extension	in. (mm)	95.5 (2,426)	83.5 (2,121)	103.4 (2,627)	91.4 (2,322)
Min. Recommended Stump Height with Retractable Stinger	in. (mm)	42.0 (1,067)		46.0 (1,169)	
Min. Recommended Stump Height with Fixed Mandrel Extension	in. (mm)	50.0 (1,270)		56.0 (1,423)	
Maximum Tool Diameter	in. (mm)	13.7 (350)		16.3 (415)	
Approximate Tool Weight	lbs (kg)	1,900 (864)	1,750 (795)	2,400 (1,091)	2,200 (1,000)
Diametrical Stroke	in. (mm)	1.37 (34.8)		1.4 (35.6)	
Die Range	in. (mm)	3.5 (88.9) - 5.5 (139.7)		3.5 (88.9) - 7.75 (196.8)	

Combined Load Operation Curve



Tool Selection Guide

Step 1: Base Tool Selection The CRTe is available in two configurations. The "Drive Module" and "Configuration Characteristics" tables contain 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 Find the appropriate die for the casing size being run in the "Summary of Selected Die Sizes" table.

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 below Die Sizes tables for every die) and F_{casing} is the pipe body yield limit found in API Bulletin 5C2.

F_{die} = efficiency x F_{casing}

For example, from API 5C3 the pipe body axial force at yield for 5.5 in. x 20.0 ppf L80 (139.7 mm x 29.76 kg/m L80) casing is 466,000 lbs (211.3 tonne). The slip efficiency for slip die 81813 used to run this casing is 80%. Therefore, the die hoist limit is:

80% × 466,000 lbs = 372,800 lbs = 186.4.5 ton

or

80% × 211.3 tonne = 169.0 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 A torque capacity limit is applied to prevent casing from yielding due to the radial load resulting from applied torque. This limit is referred to as the Die to Casing Interaction Torque Capacity. The Die to Casing Interaction Torque Capacity can be calculated using the formula:

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

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 81813 to run 5.5 in.x 20.0 ppf L80 (139.7 mm x 29.76 kg/m L80) casing, the die torque limit is:

0.02812 ft.lbs/psi/ppf × 20.0 ppf × 80,000 psi = 44,992 ft.lbs

or

3.716 N.m/MPa/(kg/m) × 29.76 kg/m × 551.6 MPa = 61,000 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 CRTe hoist capacity must be reduced by the pressure end load during circulation. The pressure end load is calculated by taking the internal cross-sectional area of the casing bore and subtracting 2.0 in^2 (representing the swept area of bore seal) and multiplying the result by the circulating pressure.

$F_{hoist,reduced} = F_{hoist,max} - F_{EndPressure}$

$F_{EndPressure} = P \times (A_{casing} - 2.0)$

Where,

$F_{hoist,reduced}$ is the max hoist capacity reduced by pressure end load

$F_{hoist,max}$ is the max rated hoist load of the tool

$F_{EndPressure}$ is the amount the hoist must be reduced due to pressure end load

P is the circulation pressure

A_{casing} is the nominal casing inner diameter cross-sectional area

For example, for circulation pressure of 500 psi (3.45 MPa) and casing nominal ID of 4.778 in (121.36 mm) the hoist reduction is:

$A_{casing} = \pi \times (4.778 \text{ in}/2)^2 = 17.93 \text{ in}^2$

500 psi × (17.93 in^2 – 2.0in^2) = 7,965 lbs

~ 4.0 ton

or

3.45 MPa × (11,568 mm^2 – 1,290 mm^2) = 35,459 N

~3.6 tonne.

Therefore, the maximum hoist reduces to:

500 ton – 4.0 ton = 496 ton (450 tonne)

Summary of Selected Die Sizes[10]

CRTe-1.0GM5.5

Die P/N[9]	Nominal Pipe Size		Max. Coupling Diameter		Max. Coupling Length		Slip to Pipe Body Load Efficiency	Torque Factor (K_{torque})	
	(in.)	(mm)	(in.)	(mm)	(in.)	(mm)	(% Fy)	(ft.lbs/psi/ppf)	(N.m/MPa/(kg/m))
102965	3.5	88.9	4.64	118.0	13.5	345	80%	0.04007	5.295
82155	4.5	114.3	5.64	143.5	13.5	345	80%	0.03467	4.581
82408	5.0	127.0	6.16	156.5	13.5	345	80%	0.03081	4.071
81813	5.5	139.7	6.60	168.0	13.5	345	80%	0.02812	3.716

CRTe-1.0GM7.75

Die P/N[9]	Nominal Pipe Size		Max. Coupling Diameter		Max. Coupling Length		Slip to Pipe Body Load Efficiency	Torque Factor (K_{torque})	
	(in.)	(mm)	(in.)	(mm)	(in.)	(mm)	(% Fy)	(ft.lbs/psi/ppf)	(N.m/MPa/(kg/m))
102965	3.5	88.9	4.93	125.5	13.5	345	80%	0.04007	5.295
82155	4.5	114.3	5.93	151.0	15.4	395	80%	0.03467	4.581
82408	5.0	127.0	6.42	163.5	15.4	395	80%	0.03081	4.071
81813	5.5	139.7	6.92	176.0	15.4	395	80%	0.02812	3.716
101730	6.0	152.4	7.29	185.5	15.4	395	80%	0.0306	4.044
101373	6.63	168.4	7.91	201.0	15.4	395	80%	0.0262	3.467
82854	7.0	177.8	8.19	208.5	15.4	395	80%	0.02577	3.405
81839	7.63	193.7	9.01	229.0	15.4	395	80%	0.02371	3.133

1. Tool hoist rating is based on API Specification 8C; however, load capacity is further constrained by local interaction of the slip dies with the casing which must not exceed the efficiency indicated for individual slip die sizes to avoid excess deformation.
2. Higher hoist up to 550 ton (500 tonne) is available upon special request.
3. Torque capacity may be limited by slip die/casing interaction.
4. 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.
5. CRTe circulation pressure capacity can be limited by packer cup pressure capacity and pressure end load. Circulation pressure capacity may be less than indicated if alternative seal arrangements are used or if it surpasses the maximum allowable pressure end loads.
6. CRTe pressure end load depends on the type of casing seal arrangement. The result must not exceed the stated maximum pressure end loads.
7. Maximum flow rate is based on managing erosion rates when using typical fluids. Erosion rates may vary based on fluid contents. 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. Overall tool length and weight will vary depending on configuration used and casing seal arrangement.
10. Values given are valid for all pipe weights specified in API 5CT.