ActiveSET™ CRTi2-5.5

Specification Summary

ActiveSET™ CRTi® Internal Grip Casing Running Tool

Volant's ActiveSET™ 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. A simple rig-up and rig-down further increases operational efficiency. The ActiveSET enhances the standard CRTi by streamlining tool activation to a single-step process by eliminating the need to manage set-down load while simultaneously rotating to the right. The tool engages by stabbing into the casing joint, allowing casing makeup to immediately begin.

The tool is available with upgraded parts to improve applications; high-capacity mandrel (CRTi2-5.5HC$_{225}$) uses stronger material for higher rated hoist capacity and low-release cams reduce the turns to stroke out needed to set and release the tool. All configurations are mechanically activated in tension and both rotational directions by top drive control using TAWG™ wedge grip technology.

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.

ActiveSET Base Tool Characteristics[1]			CRTi2-5.5	CRTi2-5.5HC225
CRTi Rated Load Capacity	Hoist	ton (tonne)	200 (181)	225 (204)
	Torque	ft.lbs (N.m)	25,000 (33,800)	25,000 (33,800)
Set-Down Load Capacity[2]		ton (tonne)	100 (90)	100 (90)
Typical Circulation Pressure Limit[3]		psi (MPa)	5,000 (34.4)	5,000 (34.4)
Maximum Pressure End Load		ton (tonne)	125 (113)	125 (113)
Base Tool Length[4]		in. (mm)	50.5 (1,285)	50.5 (1,285)
Base Tool Weight[5]		lbs (kg)	758 (344)	758 (344)
Diametrical Stroke		in. (mm)	0.52 (13.0)	0.52 (13.0)
Through Hole		in. (mm)	1.25 (32.0)	1.25 (32.0)
Maximum Flow Rate[6]		gpm (m^3/min)	449 (1.70)	449 (1.70)
Maximum Rotational Speed[7]		RPM	Unlimited	Unlimited
Tool Joint			NC50	NC50
Turns to Stroke Out[8]			1.30 / 0.66	1.30 / 0.66

Cage Specific Characteristics

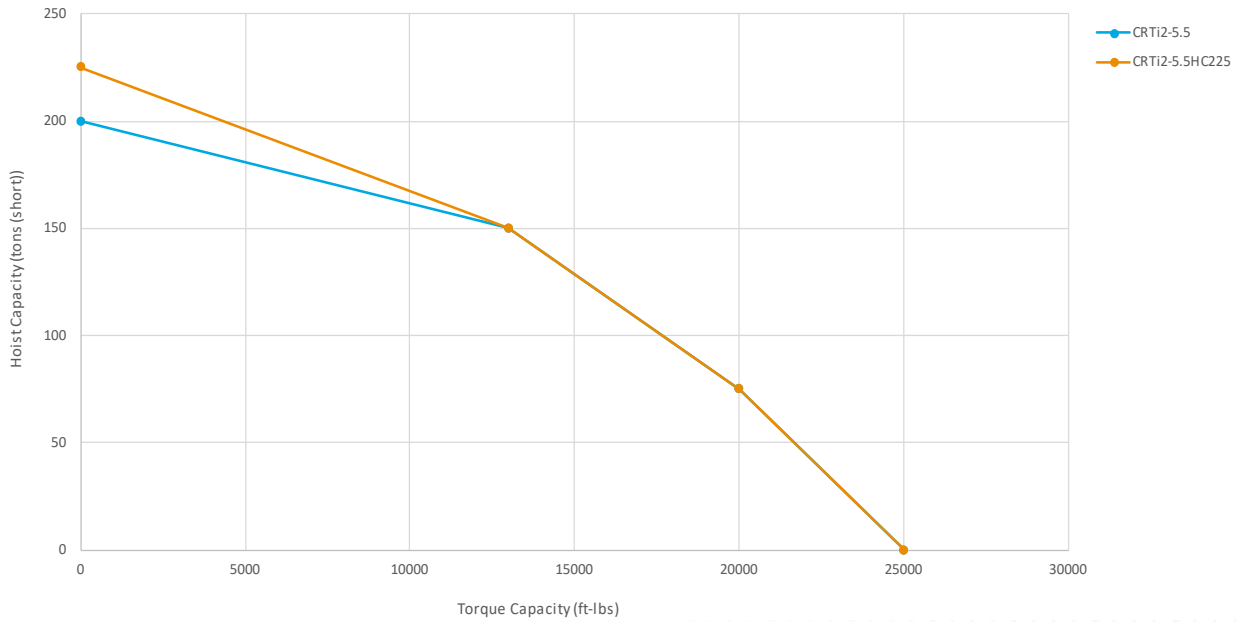
Cage P/N	Torque Capacity ft.lbs (N.m)	OD in. (mm)
81128	20,000 (27,100)	4.54 (115.3)
80912	25,000 (33,800)	4.65 (118.1)
82145	25,000 (33,800)	5.87 (149.1)

Casing Seal Assembly and Overall Tool Length

Casing Seal Description	Seal Type	Casing Size in. (mm)	CRTi2-5.5 CRTi2-5.5HC225 Overall Tool Length in. (mm)
Swivel Casing Seal	Packer Cup	5.5 (139.7)- 7.63 (193.8)	59.8 (1,520)
		8.63 (219.1) - 13.38 (339.7)	64.0 (1,630)

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 4.54 in. (115.3 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 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 81129 used to run this casing is 80%. Therefore, the die hoist limit is:

80% × 466,000 lbs = 372,800 lbs = 186.4 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 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 81129 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:

0.02222 ft.lbs/psi/ppf × 20.0 ppf × 80,000 psi = 35,552 ft.lbs

or

2.936 N.m/MPa/(kg/m) × 29.76 kg/m × 551.6 MPa = 48,196 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 1,000 psi (6.9 MPa) and casing nominal ID of 4.78 in. (121.4 mm) the hoist reduction is:

0.79 × 1,000 psi × ((4.78 in.)^2 - (1.25 in.)^2) = 16,816 lbs ~ 8.4 ton

or

0.79 × 6.9 MPa × ((121.4 mm)^2 - (31.8 mm)^2) = 74,824 N ~ 7.6 tonne

Therefore, the maximum hoist for the standard CRTi2-5.5 tool reduces to 200.0- 8.4 = 191.6 ton (173.8 tonne) or the maximum hoist for die 81129 (in step 4) must reduce to 186.4- 8.4 = 178.0 ton (161.4 tonne).

Please contact Volant for further information.

Summary of Selected Die Sizes[9]

Die P/N	Nominal Pipe Size		CRTi2-5.5 CRTi2-5.5HC225 Max. Pipe Weight[10] (W_{casing})		CRTi2-5.5 CRTi2-5.5HC225 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))
80913	5.5	139.7	17.0	25.30	14.0	20.83	80%	0.02071	2.736
81129[12]	5.5	139.7	23.0	34.23	20.0	29.76	80%	0.02222	2.936
81129	5.5	139.7	20.0	29.76	20.0	29.76	80%	0.02222	2.936
82165	6.63	168.4	24.0	35.72	20.0	29.76	79%	0.01884	2.489
80981	7.0	177.8	23.0	34.23	17.0	25.30	67%	0.01291	1.705
82013	7.0	177.8	26.0	38.69	20.0	29.76	71%	0.01369	1.808
81284	7.0	177.8	32.0	47.62	26.0	38.69	78%	0.0153	2.021
83076	7.63	193.7	29.7	44.20	24.0	35.72	79%	0.01545	2.041
82710	7.0	177.8	23.0	34.23	17.0	25.30	67%	0.01291	1.705
82712	7.0	177.8	26.0	38.69	20.0	29.76	71%	0.01369	1.808
82711	7.0	177.8	32.0	47.62	26.0	38.69	78%	0.0153	2.021
82713	7.63	193.7	29.7	44.20	24.0	35.72	79%	0.01545	2.041
82904	8.63	219.1	28.0	41.67	24.0	35.72	76%	0.01493	1.972
80987	8.63	219.1	32.0	47.62	28.0	41.67	80%	0.0158	2.087
80824	8.63	219.1	36.0	53.57	32.0	47.62	80%	0.01614	2.132
82118	9.63	244.5	36.0	53.57	32.3	48.07	73%	0.01401	1.851
82749	9.63	244.5	40.0	59.53	36.0	53.57	74%	0.01429	1.888
80825	9.63	244.5	43.5	64.74	40.0	59.53	75%	0.01452	1.918
82157	9.63	244.5	47.0	69.94	43.5	64.74	76%	-	-
80988	9.63	244.5	53.5	79.62	53.5	79.62	73%	0.00845	1.116
82021	10.75	273.1	40.5	60.27	40.5	60.27	58%	0.00547	0.722
102335	10.75	273.1	45.5	67.71	43.5	64.74	65%	0.01258	1.662
81323	10.75	273.1	51.0	75.90	51.0	75.90	58%	0.00365	0.482
81085	10.75	273.1	60.7	90.33	60.7	90.33	58%	0.00435	0.574
81955	11.75	298.5	47.0	69.94	47.0	69.94	56%	0.01076	1.421
80833	11.75	298.5	54.0	80.36	54.0	80.36	58%	0.0111	1.466
82070	11.75	298.5	60.0	89.29	60.0	89.29	59%	-	-

Summary of Selected Die Sizes[9] (continued)

Die P/N	Nominal Pipe Size		CRTi2-5.5 CRTi2-5.5HC225 Max. Pipe Weight[10] (W_{casing})		CRTi2-5.5 CRTi2-5.5HC225 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))
82756	13.38	339.7	48.0	71.43	48.0	71.43	45%	0.0086	1.136
82327	13.38	339.7	54.5	81.10	54.5	81.10	49%	0.01122	1.482
80828	13.38	339.7	61.0	90.78	61.0	90.78	48%	0.00931	1.230
81064	13.38	339.7	68.0	101.20	68.0	101.20	50%	-	-

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 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.
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 5.5 in. base tool with ActiveSET 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. Turns to Stoke Out is the rotational limit during tool makeup (this may be exceeded in combined load scenarios). The old style cams require 1.30 turns to stroke out and low-release cams only require 0.66 turns to stroke out.
9. Common die sizes shown. All API casing sizes and weights with drift diameter above 4.54 in (115.3 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 tool 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.
12. CRTi1,2-5.5 Cage (P/N: 81128) when run in conjunction with Integral Slips (P/N: 81129) enable running 5.5" 23.0ppf casing, with a reduced torque capacity of 20,000 ft.lbs. CRTi1,2-5.5 Integral Slips 80913, 82165, 80981, 82013, 81284 and 83076 can also be run with Cage (P/N: 81128) with a reduced torque capacity of 20,000 ft.lbs.