

# Emerson™ Compact Prover



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Emerson™ Compact Prover provides high accuracy, rapid operation and continuous flow for proving a flow meter in a functional line. This is accomplished without interrupting normal flow and without the use of manually operated bypass valves.

Decreased overall weight and redesigned piston and poppet assembly allows for minimal flow disturbance.

- Increased run-up time provides better accuracy for proving manufactured pulse meters
- All wetted parts and most drive-end parts are stainless steel, limiting the affects of corrosion and ensuring integrity of the system.

Emerson Compact Prover offers flexible mounting configurations on a truck or trailer for field proving of flow meters, or can be permanently installed in a testing facility either vertically or horizontally.

Pulse interpolation electronics permit exact time determination and pulse counting which provides high accuracy proving with a smaller volume and fewer flow meter pulses than any previous prover technology. The use of a small displacement volume is made possible by the high resolution of Emerson Compact Prover which is attributed to two major factors; precision optical switches, and data acquisition using double chronometry.

Precision volume detection switches are used for defining prover volume by detecting the piston position. These switches are reliable, precise and have a fast response time ( $5 \times 10^{-6}$  seconds). Data acquisition, using double chronometry, allows a much higher degree of meter pulse resolution than the  $\pm 1$  pulse common to conventional pipe provers.

Control and operation of Emerson Compact Prover is accomplished by a microprocessor based device providing the advanced electronic capabilities necessary for control in proving volumetric or mass meters.

Emerson Compact Prover conforms to design guidelines prescribed in API Chapter 4.2 and Pulse Interpolation techniques in API Chapter 4.6. All proving report formats have been designed in accordance with API standard, Chapter 12 Calculation of Petroleum Quantities of the "Manual of Petroleum Measurement".

## Included engineered features

Upon request, Compact Prover systems can include:

- Combination volumetric/mass meter prover
- Integrated density measurement
- Master Meters with flow conditioning
- Special materials, e.g., NACE compliant designs
- Custom instrumentation packages
- Trailer mounting
- Local (hazardous area) electronics with UL and ATEX hazardous area approvals
- Local and remote proving flow computers
- Inlet and outlet pressure and temperature measurement
- Flexible hoses
- Integration into flow measurement skids

## Features and benefits

Compact and portable – a single prover may be used in multiple locations for proving various sizes of meters:

- 1200:1 flow rangeability<sup>(1)</sup>
- Skid or trailer mounted

- Rapid proving operation offers single or multi-pass operation with immediate K-factor calculation
- Versatility – operates with virtually any pulse output flow meter
- Positive leak checking
- Automatic mechanical operation assures undisturbed product flow
- Corrosion resistant flow tube
- Flexibility-volumetric or mass meter proving

## Application range

- Typical fluids
- Crude oil
- Light refined product
- Refined product

## Compact prover range

- Flow Rate: 0.25 to 17,500 gpm (0.357 bph to 25,000 bph)
- Temperature<sup>(2)</sup>: -46° F to 500° F (- 43° C to 260° C)
- Pressure: 150 to 1,500 ANSI Class

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(1) Product type and pressure can affect flow rangeability.

(2) Subject to material specifications

# Specifications

If your requirements are outside the specifications noted here, consult the factory. Depending on the application, improved performance and other product and material offerings may be available.

## Performance

- Repeatability: 0.02% or better (ISO Cal Lab < 0.02%)
- Accuracy: < 0.02% - Exceeds API Standard
- Performance: < 0.02% ISO17025 Calibration Lab
- Uncertainty: Typically 0.005% (water draw)
- Pressure drop: 5 psi at max flow rate of each prover (calculated with water)

## Standard materials of construction

- Flow tube: precision machined from 304L stainless steel (316L SS optional) material and it contains all other components that contact the fluid (wetted parts)
- End flanges: Complies to 304/304L Duplex SS (316/316L Duplex SS optional).
- Wetted parts or any component with direct contact with liquid are manufactured with 304L stainless steel (316L SS optional) material
- The switch bar is made of 304SS material
- The frame is galvanized per ASTM A123 Grade 100
- The drive end components are steel with Nitro-carburizing or Zinc plating finish for corrosion resistance
- The belts are high strength carbon fiber
- The Electronic enclosures are explosion proof cast aluminum (stainless steel optional)
- The drive covers are 304 stainless steel (316SS optional)

## Paint

- Unpainted Stainless Steel Frame
- Hot Dipped Galvanized Steel Frame

## Flow tube finish

- Wrap (standard)
- Natural finish

## Electrical connections

- ½-in / 1-in NPT
- M20 / M32

## Cable specifications

- 1000 ft (305m) max for distance between flow computer and prover

	NEC	IEC
Electric	Sheathed	Armored
Control	Sheathed	Armored

## Standard Compact Prover capacities

Table 1: Flow rates and weights

Model number	Max flow rate			Displaced volume				Inlet / Outlet flange size (in)	Pressure	Weight (lbs) <sup>(1)</sup>	Weight (kg) <sup>(1)</sup>
	BPH	GPM	M <sup>3</sup> /HR	Gallons		Liters <sup>(2)</sup>					
				Primary	Secondary	Primary	Secondary				
001	142	100	23	0.75	0.35	2.9	1.3	1	--	--	--
004	428	300	68	2	1	7.5	3.8	2	--	--	--
010	1,000	700	150	5	4	20	16	3	150#	1,730	790
									300#	1,755	800
									600#	1,780	810
									900#	TBD	TBD
021	2,100	1,500	330	10	8	40	30	4	150#	2,805	1,275
									300#	2,840	1,290
									600#	2,880	1,310
									900#	3,150	1,430
035	3,570	2,500	560	20	15	75	60	6	150#	3,930	1,790
									300#	4,020	1,830
									600#	4,110	1,870
									900#	5,400	2,450
050	5,000	3,500	790	25	20	95	75	6	150#	4,180	1,900
									300#	4,280	1,945
									600#	4,380	1,990
									900#	5,600	2,540
064	6,400	4,500	1,022	35	25	130	95	8	150#	7,130	3,240
									300#	7,230	3,285
									600#	7,330	3,330

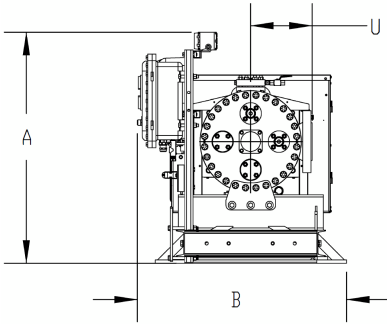
Table 1: Flow rates and weights (continued)

Model number	Max flow rate			Displaced volume				Inlet / Outlet flange size (in)	Pressure	Weight (lbs) <sup>(1)</sup>	Weight (kg) <sup>(1)</sup>
	BPH	GPM	M <sup>3</sup> /HR	Gallons		Liters <sup>(2)</sup>					
				Primary	Secondary	Primary	Secondary				
									900#	8,750	3,970
085	8,500	6,000	1,350	50	40	175	120	10	150#	8,090	3,680
									300#	8,265	3,755
									600#	8,440	3,840
									900#	9,950	4,515
128	12,850	9,000	2,000	80	60	300	250	12	150#	10,975	4,990
									300#	11,165	5,075
									600#	11,360	5,165
									900#	TBD	TBD
185	18,500	13,000	2,900	90	60	350	250	16	150#	16,765	7,605
									300#	18,110	8,215
									600#	23,225	10,535
									900#	TBD	TBD
285	28,500	20,000	4,500	140	100	520	400	20	150#	20,480	9,290
									300#	23,680	10,740
									600#	33,850	15,355
									900#	TBD	TBD
350	35,000	24,500	5,565	168	126	620	500	24	150#	TBD	TBD
									300#	TBD	TBD
									600#	TBD	TBD
									900#	TBD	TBD

(1) All weights +/- 5%. Weights here represent Full Prover without any additional piping, meters, or density loops

(2) Calibration in whole liter volumes may require an extra charge.

Figure 1: Front View



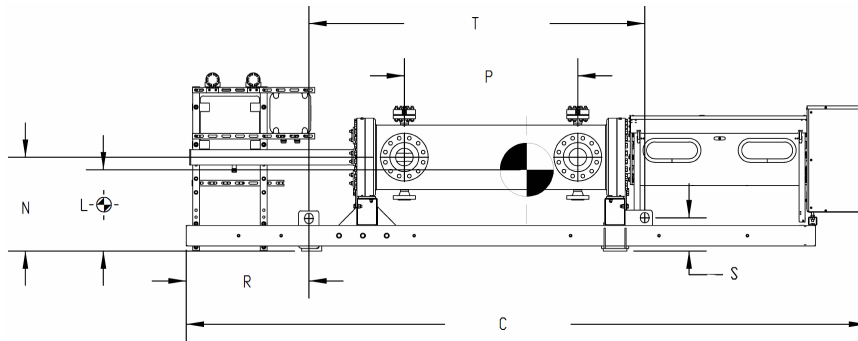
A Overall height  
 B Overall width  
 U Raised face to frame center (EMR-010 flanges are offset, see table)

Table 2: Front View Dimensions (1)(2)(3)(4)

Model	Pressure Rating	A(in)	B(in)	U (150/300/600 #) (in)	U (150/300/600 #) for EMR-010 Right Side Flange (in)
EMR-010	150/600 #	52.57	39.29	6.38/7.88/8.25	11.38/12.88/13.25
	900#	51.08	39.29	9.38	14.38
EMR-021	150/600 #	52.20	47.55	9/9.38/10.25	N/A
	900#	52.20	47.55	11.00	
EMR-035	150/600 #	52.20	47.55	12.5/12.88/14	
	900#	52.20	47.55	15.50	
EMR-050	150/600 #	52.20	47.55	12.5/12.88/14	
	900#	52.20	47.55	15.50	
EMR-064	150/600 #	53.12	58.21	15.88/16.25/17.5	
	900#	55.36	58.21	19.13	
EMR-085	150/600 #	53.14	58.21	15.5/16.13/17.88	
	900#	55.63	58.21	19.75	
EMR-128	150/600 #	59.62	58.21	19.13/19.75/21.25	
	900#	63.13	63.21	24.00	
EMR-185	150#	67.17	63.98	23.00	
	300#	67.38	63.98	24.63	
	600#	69.10	63.98	25.50	
EMR-285	150#	73.59	71.98	25.75	
	300#	73.84	71.98	26.38	
	600#	76.26	71.98	29.60	

- (1) Sizes for Prover KIT only
- (2) Dimensions here are for RR and LL flange configuration only
- (3) Spacial dimensions have tolerance of ±1 inches
- (4) All dimensions are subject to change without notice

Figure 2: Side view



- C Overall length
- L Center of Gravity
- N Mount to flange centers
- P Flange centers
- R Lifting lugs
- S Mount to mount lifting lug
- T Lifting lug spread

Table 3: Side View Dimensions (1)(2)(3)(4)

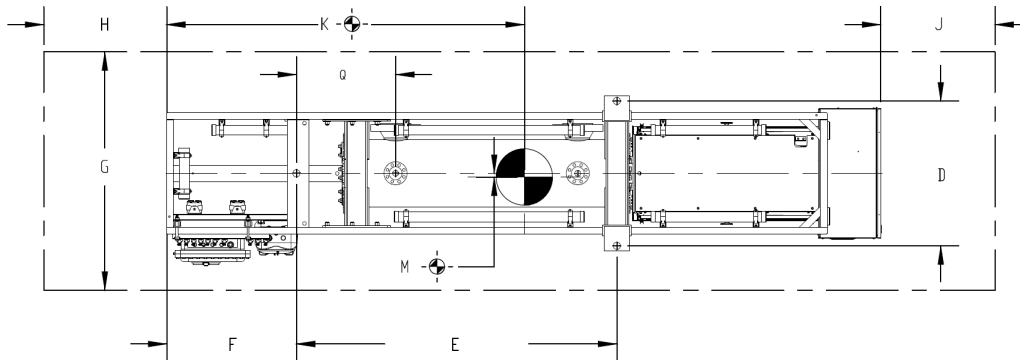
Model	Pressure Rating	C(in)	L(in) <sup>(5)</sup>	N(in) <sup>(6)</sup>	P(in)	R(in)	S(in)	T(in)
EMR-010	150/600 #	123.25	18.00	19.63	30.00	38.00	15.13	40.25
	900#	123.25	19.00	20.38	30.00	37.15	15.13	41.13
EMR-021	150/600 #	184.00	21.00	25.75	44.75	36.00	9.75	82.75
	900#	184.00	22.00	25.88	44.75	36.00	10.00	82.75
EMR-035	150/600 #	174.75	24.00	29.50	42.00	38.13	9.75	78.00
	900#	174.75	27.00	30.00	42.00	38.00	9.75	78.00
EMR-050	150/600 #	200.00	24.00	29.50	51.00	36.00	9.50	98.75
	900#	200.00	27.00	30.00	51.00	36.00	9.75	98.75
EMR-064	150/600 #	195.50	30.00	34.38	54.25	34.69	14.25	90.57
	900#	195.50	31.00	35.00	53.38	34.69	14.25	90.57
EMR-085	150/600 #	236.75	30.00	34.38	68.00	49.00	11.57	106.69
	900#	236.75	32.00	35.00	67.25	49.00	14.50	106.78
EMR-128	150/600 #	236.75	34.00	37.75	65.00	49.00	14.50	106.78
	900#	240.25	34.00	39.13	63.75	51.19	12.50	108.00
EMR-185	150#	279.50	35.00	42.25	73.00	75.25	17.25	112.00
	300#	279.50	35.00	42.25	73.00	71.38	17.25	116.25
	600# <sup>(7)</sup>	288.38	37.00	42.88	71.50	75.50	17.25	121.00
EMR-285 <sup>(7)</sup>	150#	293.75	39.00	45.38	80.00	75.63	15.75	126.00
	300#	298.50	39.00	45.50	80.00	75.50	17.25	131.00
	600#	307.50	42.00	46.75	79.50	81.25	17.63	134.38

(1) Sizes for Prover KIT only  
 (2) Dimensions here are for RR and LL flange configuration only  
 (3) Spacial dimensions have tolerance of ±1 inches  
 (4) All dimensions are subject to change without notice  
 (5) Dimensions K and L are for center of gravity within 6 inches  
 (6) Dimension P is inlet to outlet flange distance, drains and vents may vary



(7) All EMR-185 600# & EMR-285 models have 8 lifting lugs. Table gives dimensions to outermost lugs

Figure 3: Bottom view



- D Upstream mounting points
- E Upstream mounting points
- F Downstream mounting point
- G Service Area
- H Service area
- J Service area
- K Center of Gravity
- M Center of Gravity
- Q Downstream flange centers

Table 4: Bottom View Dimensions (1)(2)(3)(4)

Model	Pressure Rating	D(in)	E(in)	F(in)	G(in)	H(in)	J(in)	K(in) <sup>(5)</sup>	M(in)	Q(in)
EMR-010	150/600 #	29.00	43.00	35.25	97.00	30.00	30.00	69.00	1.00	7.88
	900#	29.00	43.88	34.38	97.00	30.00	30.00	70.00	2.00	8.38
EMR-021	150/600 #	40.50	73.75	36.31	109.00	30.00	30.00	95.00	3.00	22.75
	900#	40.50	73.75	36.31	109.00	30.00	30.00	94.00	3.00	22.00
EMR-035	150/600 #	40.50	76.75	30.63	109.00	30.00	30.00	86.00	2.00	25.25
	900#	40.50	76.75	30.63	109.00	30.00	30.00	84.00	2.00	24.32
EMR-050	150/600 #	40.50	89.75	36.38	109.00	30.00	30.00	100.00	1.00	27.75
	900#	40.50	89.75	36.38	109.00	30.00	30.00	96.00	1.00	26.88
EMR-064	150/600 #	51.50	84.25	35.00	120.00	30.00	30.00	95.00	1.00	24.50
	900#	51.50	84.25	35.00	120.00	30.00	30.00	93.00	1.00	23.25
EMR-085	150/600 #	51.50	100.50	49.25	120.00	30.00	30.00	120.00	1.00	24.75
	900#	51.50	100.50	49.25	120.00	30.00	30.00	116.00	1.00	23.88
EMR-128	150/600 #	51.50	100.50	49.25	120.00	30.00	30.00	114.00	2.00	25.13
	900#	56.50	93.63	58.57	124.00	30.00	30.00	155.00	2.00	18.57
EMR-185	150#	56.00	94.13	86.50	124.00	30.00	30.00	160.00	2.00	10.63
	300#	56.00	98.25	82.38	124.00	30.00	30.00	155.00	1.00	12.63
	600#	56.00	106.00	84.50	124.00	30.00	30.00	157.00	1.00	17.75
EMR-285	150#	64.00	108.13	86.50	132.00	30.00	30.00	152.00	1.00	14.13
	300#	64.00	115.13	84.50	132.00	30.00	30.00	162.00	2.00	18.50

**Table 4: Bottom View Dimensions <sup>(1)(2)(3)(4)</sup> (continued)**

Model	Pressure Rating	D(in)	E(in)	F(in)	G(in)	H(in)	J(in)	K(in) <sup>(5)</sup>	M(in)	Q(in)
	600#	64.00	121.13	87.50	132.00	30.00	30.00	163.00	2.00	21.75

- (1) Sizes for Prover KIT only
- (2) Dimensions here are for RR and LL flange configuration only
- (3) Spacial dimensions have tolerance of ±1 inches
- (4) All dimensions are subject to change without notice

**Table 5: Power**

Model	Motor horsepower	Motor amperage draw					
		24 A VDC (A)	120 VAC single phase (A)	230 VAC (A)	230 VAC 3-phase (A)	230 VAC single phase (A)	460 VAC 3-phase (A)
004	0.75	28.2	10.6	5.3	3.2	CF	1.5
010	0.75	28.2	10.6	5.3	3.2	CF	1.5
021	1.00	40	13	6.5	3	2 <sup>(1)</sup>	1.5
035	1.00	40	13	6.5	3	2 <sup>(1)</sup>	1.5
050	1.00	N/A	13	6.5	3	2 <sup>(1)</sup>	1.5
064	1.50	N/A	19	11	3.8	CF	1.9
085	1.50	N/A	19	11	3.8	CF	1.9
128	2.00	N/A	22	11	5.8	CF	2.9
185	7.50	N/A	N/A	N/A	19	CF	9.5
285	7.50	N/A	N/A	N/A	19	CF	9.5

- (1) 50 Hz Operation Only

CF = consult factory

**Table 6: Pressure drop chart**

Test Conditions: Water flowing through the prover at maximum flow rate with the piston in the downstream position, piston open and not proving. Pressure drop is across the piston assembly.

EMR	Maximum flow rate (BPH)	Pressure drop ±1 PSI
004	428	5
010	1000	5
021	2100	5
035	3570	5
050	5000	5
064	6400	5
085	8,500	5
128	12,850	5
185	18,500	5
285	28,500	5

**Note**

Typical pressure drop during the proving pass is 1 psi on all liquid products.

## Standard factory test

- Hydrostatic: Chart recorded pressure test to 1.5 times max working pressure
- Water draw: Calibration test within 0.02% repeatability traceable to NIST
- Functional: Verifies functionality of prover, components (i.e., instrumentation) and repeatability as per API Chapter 4

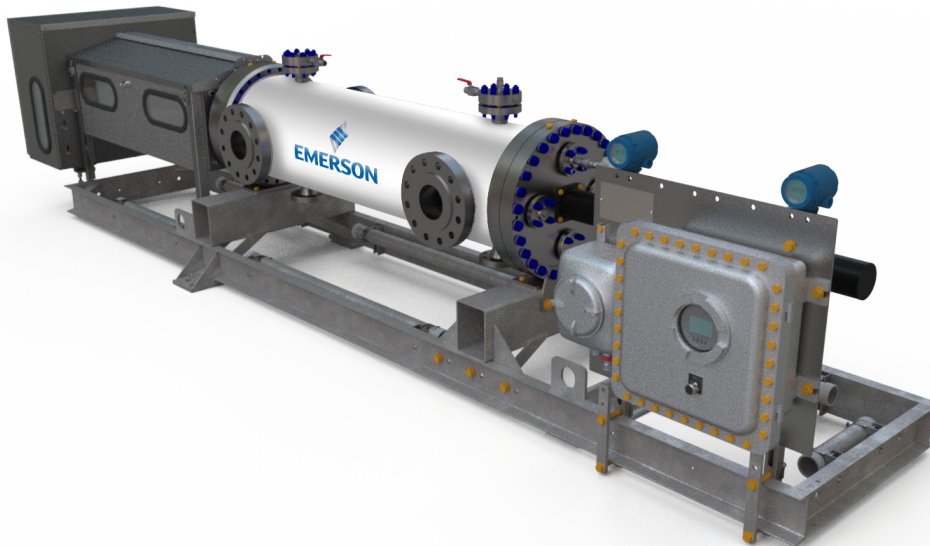
## Hazardous location approval

CE Mark for the European Community, including all applicable European directives and standards. Ex de ia m IIB T3 (ATEX, PED) Canadian Standards Association (CSA International) approval for hazardous locations, Class I, DIV. 1, Group D Electrical systems conforming to National Electrical Code, Class I, Div. 1, Group D or CSA Std C22.2, Class I, DIV. 1, Group D, using UL/CSA approved components only

## Weather proofing

	NEC	IEC
Enclosure	NEMA4	IP66
Motors	NEMA3	IP54

Figure 4: Prover unit

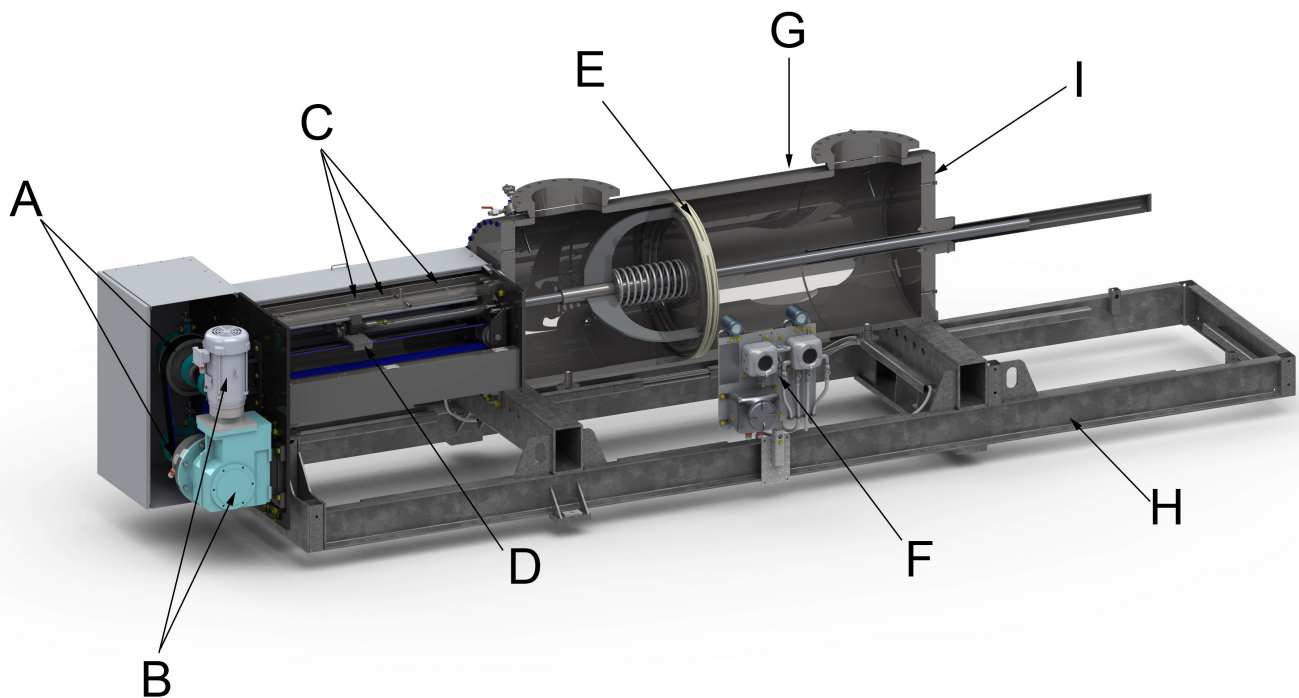


## Engineered proving solutions

Emerson offers an engineered solution to all of today's proving challenges. From low pressure (150# ANSI) to high pressure (1500# ANSI) operations, to NACE certified materials, all aspects of the proving requirement are reviewed and the compact prover is engineered for safe, reliable service.

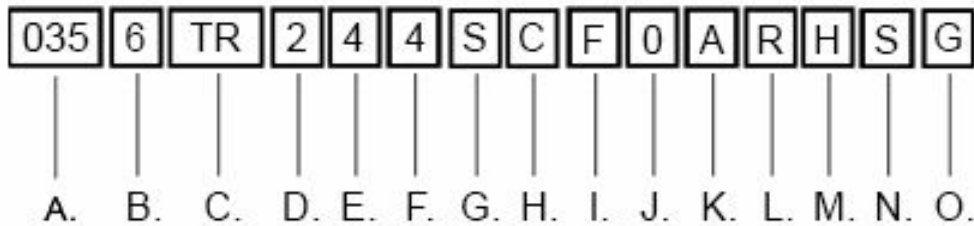
Above all, Emerson designs, builds, and maintains engineered proving solutions for all of today's flow measurement challenges.

**Figure 5: Compact Prover cross sectional view**



- A. Belt / clutch drive assembly
- B. Motor gearbox
- C. Switch bar with optical switches
- D. Belt driven shuttle assembly
- E. Piston assembly in closed position
- F. PIM controller and electrical panel
- G. Flow tube (barrel)
- H. Prover frame
- I. End flange

## Emerson Compact Prover model code



- A. Maximum flow rate (BPH)
- B. Pressure rating
- C. Flange configuration
- D. Flange type
- E. Wetted materials
- F. Drive end materials
- G. Structural components
- H. Seal material
- I. Motor voltage
- J. Frequency
- K. Area classification
- L. Panel location
- M. Covers type
- N. Tube finish
- O. Calibration units

### Maximum flow rate (BPH)

Model	Flow rate
001	142
004	428
010	1,000
021	2,100
035	3,570
050	5,000
064	6,400
085	8,500
128	12,850
185	18,500
285	28,500
350	35,000

## Pressure rating

Code	Case option
1	150#
3	300#
6	600#
9	900#
Z	Special

## Flange configuration

Code	Case option
RR	Right in - right out
RL	Right in - left out
RT	Right in - top out
LL	Left in - left out
LR	Left in - right out
LT	Left in - top out
TT	Top in - top out
TR	Top in - right out
4A	4 flange

## Flange type

Code	Flange type
1	Raised face
2	Ring joint

## Wetted materials

Code	Material
4	304 SS
6	316 SS

## Drive end materials

Code	Material
4	304 SS

Code	Material
6	316 SS

## Structural components

Code	Case option
C	Unpainted carbon steel
G	Galvanized steel

## Seal material

Code	Material
C	Carbon
E	Ekonol
N	NGL Service
Z	Special

## Motor voltage

Code	Voltage
A	24 VDC <sup>(1)</sup>
B	110-120 VAC - 1 Phase <sup>(1)</sup>
C	220/230/240 VAC - 1 Phase
D	190/208-230/240 VAC - 3 Phase
E	380/400/415 VAC - 3 Phase
F	440/460/480 VAC - 3 Phase

(1) Not available with low ambient temperature.

## Frequency

Code	Frequency
0	DC
5	50 Hz
6	60 Hz

## Area classification

Code	Classification
A	UL/CSA Class 1 Div 1 40C
B	UL/CSA Class 1 Div 1 60C
C	UL/CSA Class 1 Div 2 40C
D	UL/CSA Class 1 Div 2 60C
E	ATEX Ex d mb [ia] IIB T3 Gb -20 to 40C
F	IECE Ex d mb [ia] IIB T3 Gb -20 to 40C

## Panel location

Code	Case option
L	Left side
R	Right side

## Covers type

Code	Type
S	Standard (quick access)
P	Purge (≅ -20F product)
H	High temp

## Tube finish

Code	Case option
S	Wrap (standard)
B	Natural finish

## Calibration units

Code	Unit
G	Gallons
L	Liters









For more information: [www.emerson.com](http://www.emerson.com)

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