HYDRAULIC TEST ACTUATOR

SINGLE-ENDED

Rev. A. July 2024

DELIVERING FLEXIBILITY AND RELIABILITY FOR A RANGE OF SINGLE AND MULTIPLE CHANNEL TEST SYSTEMS

MOOG | Shaping the way our world moves™

Whenever the highest levels of motion control performance and design flexibility are required, you'll find Moog expertise at work. Through collaboration, creativity and world-class technological solutions, we help you overcome your toughest engineering obstacles. Enhance your machine's performance, achieve greater efficiencies and help take your thinking further than you ever thought possible.

OVERVIEW

Actuators are at the heart of high performance test systems such as those used for aerospace structural testing. For years, test engineers have been looking for actuators that deliver dependability, less maintenance and high performance, yet are available at an affordable price. Their expectation has been to expedite tests to obtain accurate test results more efficiently.

With deep roots in electro-hydraulic servo control expertise and global test experience, Moog has designed servo actuators for some of the world's most demanding applications – from Primary Flight Control System Actuators to Automatic Gap Control Actuators used in steel mill production line.

Today, Moog engineers have further developed a new series of Fatigue Rated Actuators, the C086A3 Single-Ended Hydraulic Test Actuator to meet the critical test needs of test engineers.

Actuator Series Code: C086A3

Features	**Benefits**
8 force sizes as standard (Tension force): · 14 kN (3.0 kip) · 31 kN (6.8 kip) · 63 kN (13.8 kip) · 98 kN (21.5 kip) · 149 kN (32.7 kip) · 284 kN (62.4 kip) · 453 kN (99.6 kip) · 1137 kN (250.1 kip) 4 stroke lengths as standard: · 300 mm (12 in) · 500 mm (20 in) · 750 mm (30 in) · 1000 mm (40 in)	Wide array of sizes and flexibility Easy to size and fit the applications
· Regular manifold with up to 2xG761 high performance servo valves · Safety-Abort Manifold for large scale, multiple channel and synchronized aerospace testing · Filter add-on	Wider servo valve selection – meet the speed and response required Ultimate safety and protection to test article Contamination free and protect servo valve
· "Building Block" concept and COTS (Commercial-Off-The-Shelf) components	Quick selection and short lead time Lower acquisition cost
· Contact-less, coaxial linear position sensors · Position sensor multiple output signal format	Performance – higher durability and more reliable Easy to adapt to any test controller
High accuracy loadcell, dual-bridge	Higher test accuracy and test safety
Multiple mounting options	Wider mounting options to ease the selection and adaptation to application
Multiple hydraulic porting	Easy and flexibility to adapt to specific application scenarios

Solutions Built Around You

Moog Single-Ended Hydraulic Test Actuator is a heavy duty and fatigue rated design component. It delivers higher reliability, less maintenance and cost-effective performance for test labs seeking the competitive edge.

Typical Applications:

· Aerospace structural static and fatigue testing

· Civil engineering testing

· General industrial servo control applications

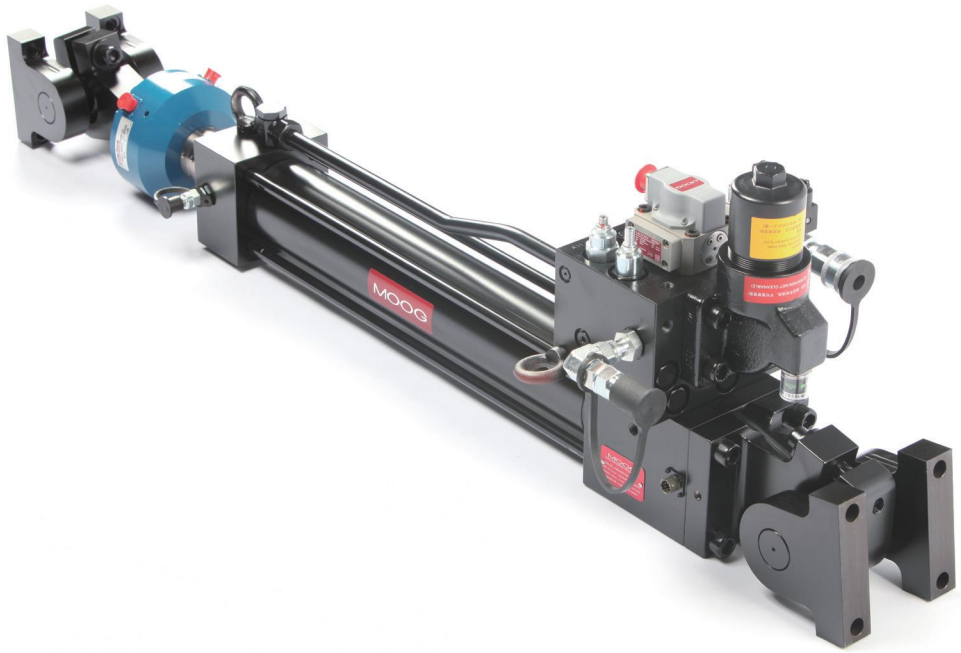
SPECIFICATIONS

Model Number	Construction Style	NominalForce*		Rod Dia	Bore Dia	Effective Area		Working Stroke
		Tension	Compression			Tension	Compression	
		kN (kip)	kN (kip)	mm (in)	mm (in)	mm^2 (in^2)	mm^2 (in^2)	mm (in)
C086A31	Tie Rod Style	14 (3.1)	40 (9.0)	40 (1.6)	50 (2.0)	710 (1.1)	1963 (3.04)	300,500,750,1000 (12,20,30,40)
C086A32		31 (7.0)	64 (14.4)	45 (1.8)	63 (2.5)	1527 (2.37)	3117 (4.83)	300,500,750,1000 (12,20,30,40)
C086A33		63 (14.2)	104 (23.4)	50 (2.0)	80 (3.1)	3063 (4.75)	5027 (7.79)	300,500,750,1000 (12,20,30,40)
C086A34		98 (22)	162 (36.4)	63 (2.5)	100 (4.0)	4737 (7.34)	7854 (12.17)	300,500,750,1000 (12,20,30,40)
C086A35		149 (33.5)	253 (56.9)	80 (3.1)	125 (4.9)	7245 (11.23)	12272 (19.02)	300,500,750,1000 (12,20,30,40)
C086A36		284 (63.8)	416 (93.5)	90 (3.5)	160 (6.3)	13744 (21.3)	20106 (31.16)	300,500,750,1000 (12,20,30,40)
C086A37	Column Style	453 (101.8)	650 (146.1)	110 (4.3)	200 (7.9)	21913 (33.97)	31416 (48.69)	300,500,750,1000 (12,20,30,40)
C086A38		1137 (255.6)	1663 (373.9)	180 (7.1)	320 (12.6)	54978 (85.22)	80425 (124.66)	300,500,750,1000 (12,20,30,40)

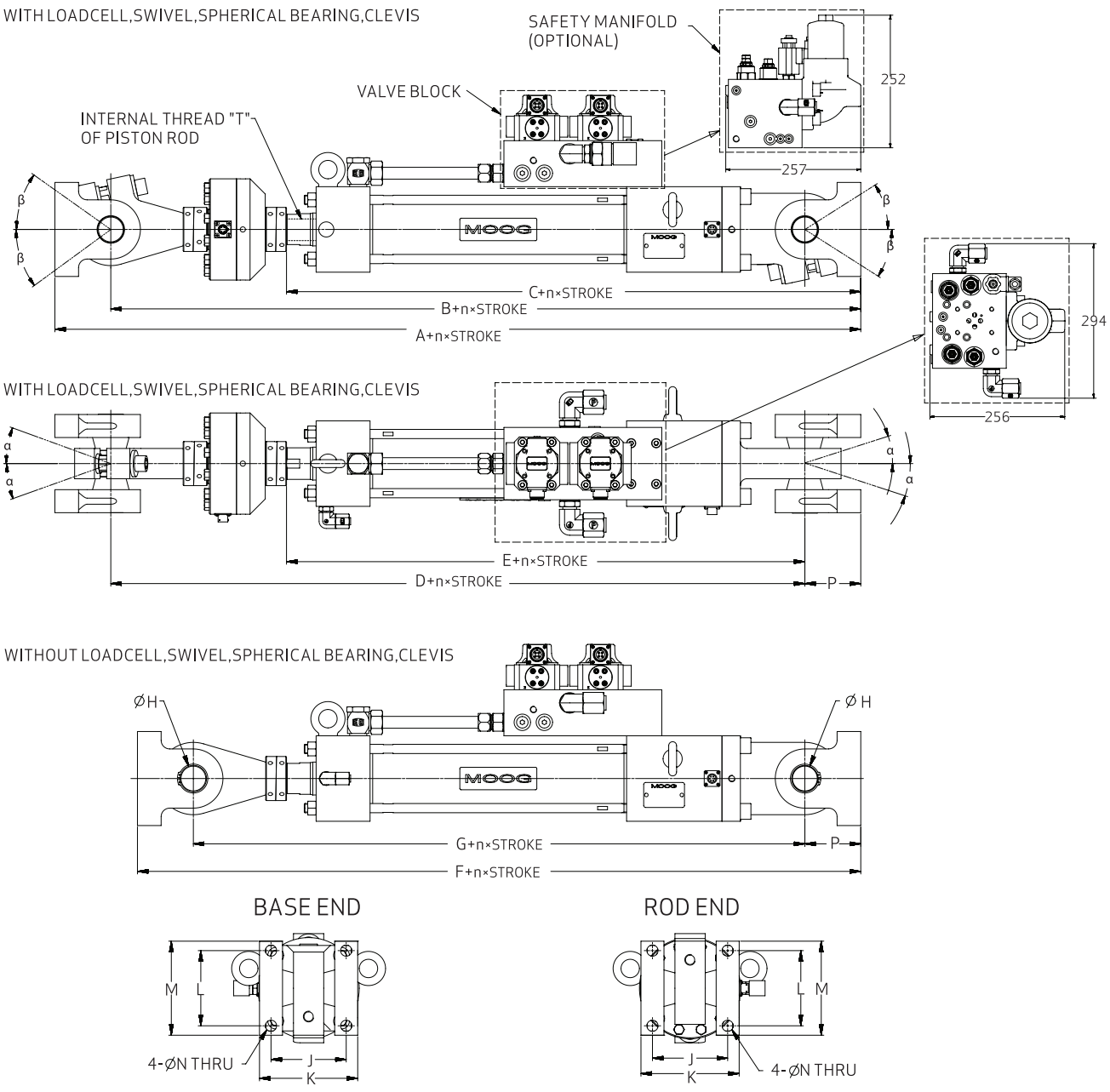
*Calculated at 207 Bar (3000 psi)

Additional Actuator Specifications

Pressure	
Operating pressure Maximum return pressure Maximum drain pressure	21 MPa (3000 psi) 1.4 MPa (200 psi) 0.35 MPa (50 psi)
Seal	
Material	NBR
Hydraulic Interface	
Pressure line Return line Drain line	JIC 37° Flare End (SAE -12), or Male quick coupling 1/2"-14 BSPP JIC 37° Flare End (SAE -12), or Female quick coupling 1/2"-14 BSPP JIC 37° Flare End (SAE -6), or Male quick coupling 1/4"-19 BSPP
Operation Temperature Range	
Hydraulic oil temperature	24 °C (75 °F) to 57 °C (134 °F)
Oil Requirements	
System fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO VG 32, 46 or equivalent
Cleanliness level	ISO 4406 (SAE J1165) 15/14/11 (NAS 5)
Standard electrical connector mates with following, or equivalent (IP65)	
G761 servo valve Position transducer & load cell	MS3106F14S-2S PT06A-10-6S

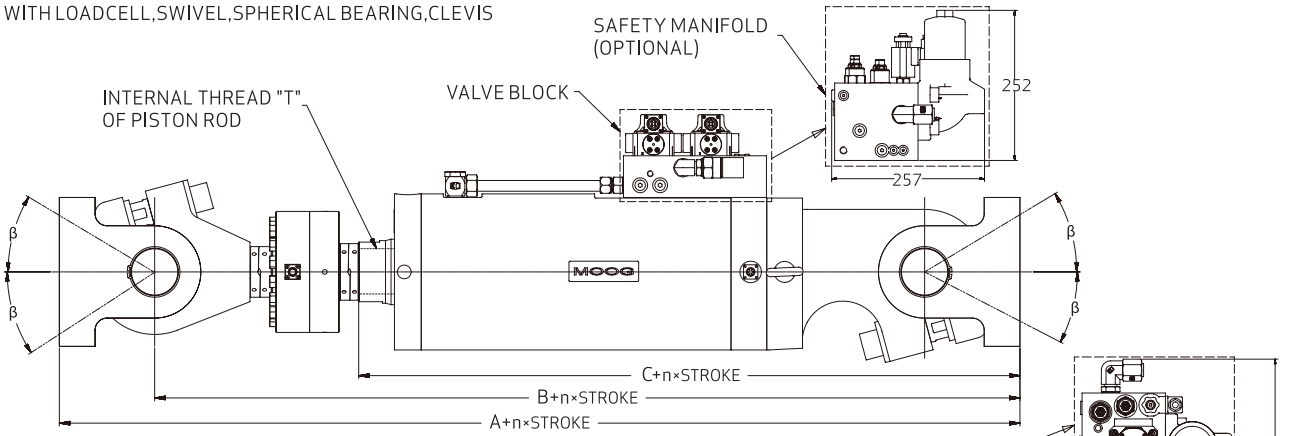


DIMENSIONS – TIE ROD STYLE (C086A31/A32/A33/A34/A35/A36)

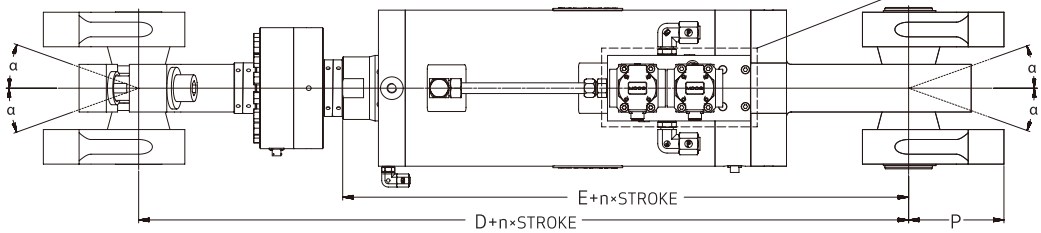


DIMENSIONS – COLUMN STYLE (C086A37/A38)

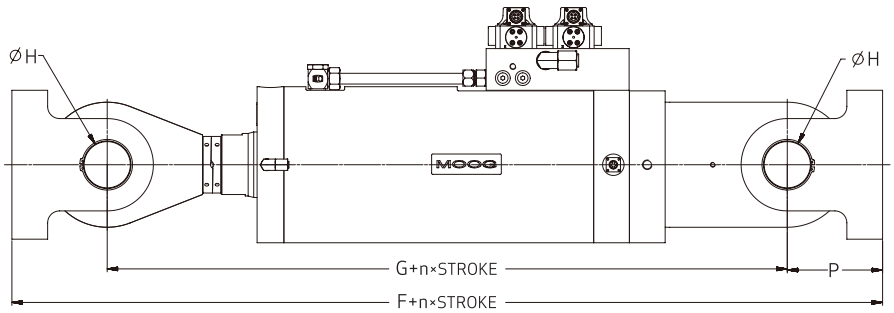
WITH LOADCELL,SWIVEL,SPHERICAL BEARING,CLEVIS



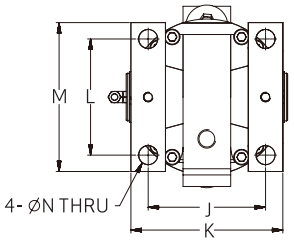
WITH LOADCELL,SWIVEL,SPHERICAL BEARING,CLEVIS



WITHOUT LOADCELL,SWIVEL,SPHERICAL BEARING,CLEVIS

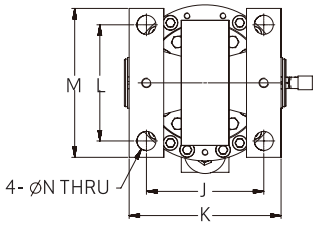


BASE END

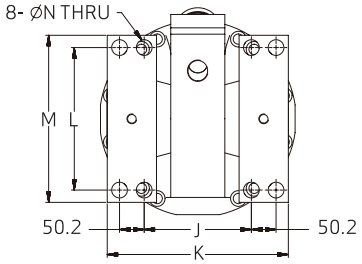


C086A37 SER

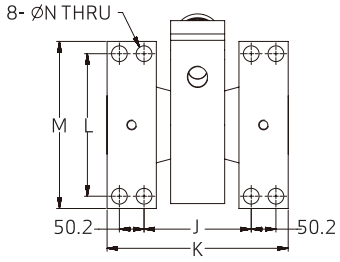
ROD END



C086A37 SER



C086A38 SER



C086A38 SER

Model Number	Nominal Force kN (kip)	A		B		C		D	
		FULLY RETRACTED n=1 mm (in)	FULLY EXTENDED n=2 mm (in)	FULLY RETRACTED n=1 mm (in)	FULLY EXTENDED n=2 mm (in)	FULLY RETRACTED n=1 mm (in)	FULLY EXTENDED n=2 mm (in)	FULLY RETRACTED n=1 mm (in)	FULLY EXTENDED n=2 mm (in)
C086A31	14/40 (3.1/9.0)	691 (27.2)	691 (27.2)	631 (24.8)	631 (24.8)	455 (17.9)	455 (17.9)	571 (22.5)	571 (22.5)
C086A32	31/64 (6.9/14.4)	725 (28.5)	725 (28.5)	665 (26.2)	665 (26.2)	489 (19.3)	489 (19.3)	605 (23.8)	605 (23.8)
C086A33	63/104 (14.1/23.4)	925 (36.4)	925 (36.4)	840 (33.1)	840 (33.1)	573 (22.6)	573 (22.6)	755 (29.7)	755 (29.7)
C086A34	98/162 (22.0/36.4)	952 (37.5)	952 (37.5)	867 (34.1)	867 (34.1)	599 (23.6)	599 (23.6)	782 (30.8)	782 (30.8)
C086A35	149/253 (33.5/56.9)	1125 (44.3)	1125 (44.3)	997 (39.3)	997 (39.3)	704 (27.7)	704 (27.7)	869 (34.2)	869 (34.2)
C086A36	284/416 (63.9/93.6)	1293 (50.9)	1293 (50.9)	1135 (44.7)	1135 (44.7)	792 (31.2)	792 (31.2)	977 (38.5)	977 (38.5)
C086A37	453/650 (101.9/146.2)	1313 (51.7)	1313 (51.7)	1153 (45.4)	1153 (45.4)	810 (31.9)	810 (31.9)	993 (39.1)	993 (39.1)
C086A38	1137/1663 (255.8/374.1)	1702 (67.0)	1702 (67.0)	1492 (58.7)	1492 (58.7)	967 (38.1)	967 (38.1)	1492 (59.7)	1492 (59.7)

Model Number	Nominal Force kN (kip)	E		F		G		H mm (in)	T mm (in)
		FULLY RETRACTED n=1 mm (in)	FULLY EXTENDED n=2 mm (in)	FULLY RETRACTED n=1 mm (in)	FULLY EXTENDED n=2 mm (in)	FULLY RETRACTED n=1 mm (in)	FULLY EXTENDED n=2 mm (in)		
C086A31	14/40 (3.1/9.0)	395 (15.6)	395 (15.6)	601 (23.7)	601 (23.7)	481 (18.9)	481 (18.9)	25 (1.0)	M27X2 ↧40
C086A32	31/64 (6.9/14.4)	429 (16.9)	429 (16.9)	635 (25.0)	635 (25.0)	515 (20.3)	515 (20.3)	25 (1.0)	M27X2 ↧40
C086A33	63/104 (14.1/23.4)	488 (19.2)	488 (19.2)	800 (31.5)	800 (31.5)	630 (24.8)	630 (24.8)	40 (1.6)	M27X2 ↧60
C086A34	98/162 (22.0/36.4)	514 (20.2)	514 (20.2)	826 (32.5)	826 (32.5)	656 (25.8)	656 (25.8)	40 (1.6)	M33X2 ↧50
C086A35	149/253 (33.5/56.9)	576 (22.7)	576 (22.7)	999 (39.3)	999 (39.3)	743 (29.3)	743 (29.3)	60 (2.4)	M33X2 ↧50
C086A36	284/416 (63.9/93.6)	634 (25.0)	634 (25.0)	1142 (45.0)	1142 (45.0)	842 (33.1)	842 (33.1)	80 (3.1)	M42X2 ↧60
C086A37	453/650 (101.9/146.2)	650 (25.6)	650 (25.6)	1162 (45.7)	1162 (45.7)	842 (33.1)	842 (33.1)	80 (3.1)	M52X2 ↧105
C086A38	1137/1663 (255.8/374.1)	1282 (50.5)	1282 (50.5)	1463 (57.6)	1463 (57.6)	1043 (41.1)	1043 (41.1)	120 (4.7)	M90X3 ↧110

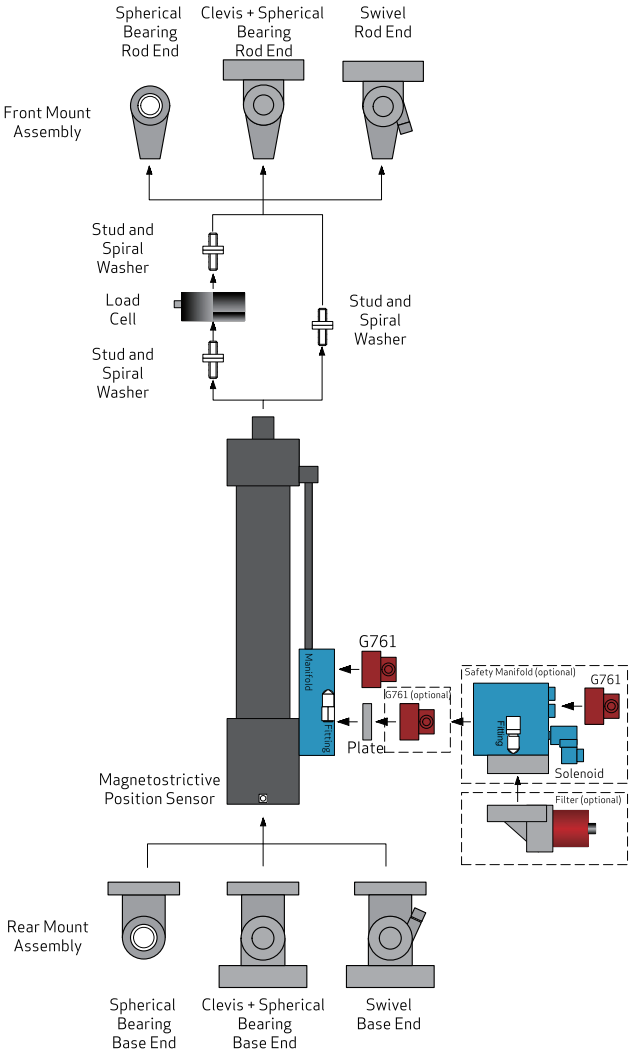
Model Number	Nominal Force kN (kip)	J mm (in)	K mm (in)	L mm (in)	M mm (in)	N mm (in)	P mm (in)	α	β
C086A31	14/40 (3.1/9.0)	63.5 (2.5)	85.5 (3.4)	63.5 (2.5)	86 (3.4)	11 (0.4)	60 (2.4)	+/-7°	+/-80°
C086A32	31/64 (6.9/14.4)	63.5 (2.5)	85.5 (3.4)	63.5 (2.5)	86 (3.4)	11 (0.4)	60 (2.4)	+/-7°	+/-80°
C086A33	63/104 (14.1/23.4)	114.3 (4.5)	149.3 (5.9)	114.3 (4.5)	143 (5.6)	17 (0.7)	85 (3.3)	+/-17°	+/-90°
C086A34	98/162 (22.0/36.4)	114.3 (4.5)	149.3 (5.9)	114.3 (4.5)	143 (5.6)	17 (0.7)	85 (3.3)	+/-17°	+/-90°
C086A35	149/253 (33.5/56.9)	146 (5.7)	186 (7.3)	146 (5.7)	188 (7.4)	17 (0.7)	128 (5.0)	+/-17°	+/-90°
C086A36	284/416 (63.9/93.6)	148 (7.2)	234 (9.2)	184 (7.2)	230 (9.1)	26 (1.0)	158 (6.2)	+/-14°	+/-90°
C086A37	453/650 (101.9/146.2)	197 (7.8)	255 (10.0)	195 (7.7)	250 (9.8)	32 (1.3)	160 (6.3)	+/-14°	+/-90°
C086A38	1137/1663 (255.8/374.1)	218.1 (8.6)	368.5 (14.5)	290 (11.4)	340 (13.4)	32 (1.3)	210 (8.3)	+/-6°	+/-90°

Notes:
FACTOR n = 1 (FULLY RETRACTED)
n = 2 (FULLY EXTENDED)
STROKE = 300 mm, 500 mm, 750 mm, AND 1000 mm

CONFIGURATION ACTUATOR TO MEET YOUR NEEDS

A variety of building blocks are available to configure the exact actuator per test rig design or application requirements (see illustrative drawing at right).

Various Moog high performance servo valves and load cells are provided to help application engineer to pick up the right one for a specific actuator to avoid over-sizing or under-sizing. Mounting joints and bases are also provided to adapt to the installation requirements.



OPTIONS

Regular Manifold and Safety-Abort Manifold

Two types of Servo Valve manifolds available:

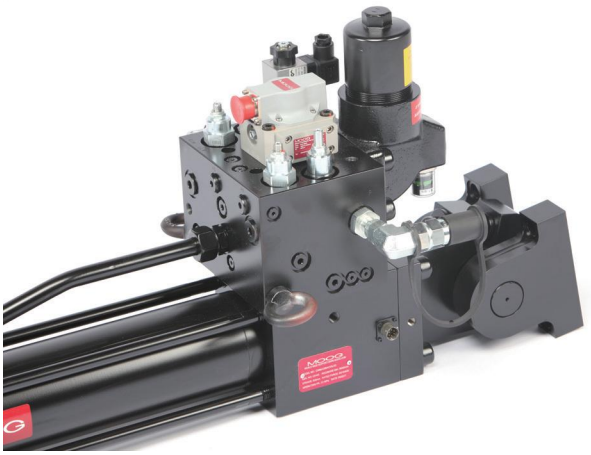
- Regular servo valve block
- Safety Abort Manifold

Regular servo valve block allows 2x G761 to be sized to meet the application needs. Maximum flow 126 l/min.

Safety-Abort Manifold is a more safe configuration to provide a mechanism to dump the hydraulic pressure thus to remove the loading force from the test specimen. This is particularly needed for typical aerospace structure testing.

- An additional solenoid/coil is equipped to provide a control to dump the pressure within actuator back to tank;
- 2x sequence valves to independently setup the maximum working pressure for both chambers;
- 2x needle valves to provide an offloading speed setup for both chambers;
- Only 1xG761 is needed;
- Customer can select an additional 10 micron filter to provide further protection to the Servo Valve from oil contamination
- Porting style:

- JIC 37° flare
- Quick Coupling



Load Cell

High performance load cell can be adapted to the actuators to provide a force feedback to a closed loop control.

Dual-bridge is the default selection.

Spiral washer can be provided as well for preload creation.

Load cell Accuracy: ⩽ 0.5% F.S.

Position Sensor

Although in some applications the position feedback is not a must, sensing the position is always adding an extra dimension to know the status of the actuator beyond the loadcell itself.

- Contact-less style.
- Internal, co-axial installed position sensor as standard configuration.
- Signal type:

- Analog voltage signal output as standard
- SSI signal output is also available.

- Repeat accuracy: ⩽ ±10 µm
- Non-linearity: ⩽ ±0.01% F.S.

Mounting Interface

Either for rod end or actuator base, three mounting options are available to adapt to different needs of applications:

- Spherical Bearing
- Clevis + Spherical Bearing
- Swivel

Spherical bearing provides a Pin-to-Pin interfacing with the customer's test article

Clevis + Spherical Bearing is a Face-to-Face interfacing solution with the customer's test article

Swivel provides more fatigue oriented Face-to-Face solution. The swivel also allow you to eliminate the possible free-play existing in the bearing due to a long time operation

ORDERING CODE

C086A3 X X X X X XX X XXXX

Test Actuator

Model Revision

Actuator Type	
3	Single-ended Actuator

Actuator Force		
Specify	Force Rated @207 bar Tension/Compression	
	kN	kip
1	14/40	3.0/8.8
2	31/64	6.8/14.0
3	53/104	13.8/22.8
4	98/162	21.5/35.6
5	149/253	32.7/55.6
6	284/416	62.4/91.5
7	453/650	99.6/143.0
8	1137/1663	250.1/365.8

Working Stroke		
Specify	mm	inch
A	300	12
B	500	20
C	750	30
D	1000	40

Servo Valve		
Specify	Type(Qty)	Rated Flow
A	G761-3005(x1)	63 l/min (16.5 gpm)
B	G761-3003(x1)	19 l/min (5 gpm)
D	G761-3005(x2)	2x63 l/min (33 gpm)
E	G761-3003(x2)	2x19 l/min (10 gpm)
F	None	
G	G761-3002(x1)	10 l/min (2.5 gpm)
H	G761-3004(x1)	38 l/min (10 gpm)
J	G761-3002(x2)	2x10 l/min (5 gpm)
K	G761-3004(x2)	2x38 l/min (20 gpm)
L	G761-3001(x1)	4 l/min (1 gpm)
M	G761-3001(x2)	2x4 l/min (2 gpm)
Mounting Patten ISO 10372-04-04-0-92		

Manifold	
Specify	Description
B	Regular, wth 2x servo valve mounting positions
C*	Safety manifold with 1x servo valve position, with filter
E*	Safety manifold with 1x servo valve position, without filter
* Safety manifold with only 1x servo valve position Mounting pattern ISO 10372-04-04-0-92	

Special	
SXX*	Special
Blank	Standard
* See note 3 for special loadcell	

Hydraulic Port Type	
Specify	Type
J	JIC 37° Flare (ISO8434-2)
Q	Quick Coupling

Position Sensor Output	
Specify	Type
0	None
1	Digital, SSI
3	Analog, 0-10V

Rod End Configuration	
Specify	Type
0N	None
1W	Spherical Bearing + Spiral Washers
2W	Clevis + Spherical Bearing + Spiral Washers
3W	Swivel Head + Spiral Washers
1L	Spherical bearing + Spiral washers + Loadcell* (for tension applications)
2L	Clevis + Spherical bearing + Spiral washers + Loadcell* (for tension applications)
3L	Swivel head + Spiral washers+ Loadcell* (for tension applications)
4L	Spherical bearing + Spiral washers + Loadcell* (for compression applications)
5L	Clevis + Spherical bearing + Spiral washers + Loadcell* (for tension applications)
6L	Swivel head + Spiral washers+ Loadcell* (for compression applications)
Spherical bearing: non-adjustable Clevis + Spherical bearing: non-adjustable Swivel head: gap adjustable * See note 1 and 2 for loadcell selection	

Mounting Base	
Specify	Type
1	Spherical Bearing
2	Clevis +Spherical Bearing
3	Swivel Base
Spherical Bearing: non-adjustable Clevis+Spherical Bearing: non-adjustable Swivel Base: gap-adjustable	

Notes :

1. Standard : dual bridge of INTERFACE 1200 series or equivalent
2. For tension applications, the loadcell range will be selected to match actuator tension force rating
   For compression applications, the loadcell range will be selected to match actuator compression force rating
3. If other loadcell model is requested, please consult Moog engineer

A HIGHER LEVEL OF SUPPORT

The actuator was designed to provide long life, and inexpensive, fast and easy repair when it is finally necessary. Moog can provide the typical wear items such as a replaceable bearing and the seals for your own repair. Or you can have Moog repair the actuator to a like-new condition.

Five Point Inspection Process

Our number one goal is to eliminate downtime and make repairs that will deliver reliability and cost savings for years to come. When you send in your repair, it must work like new when you get it back. This is the Moog Global Support promise.

- Incoming inspection will provide the customer details on the performance of the actuator assembly such as leakage and response. The inspection will also provide details to our technicians in regards to critical performance specs that need to be addressed.
- Technicians will then review engineering notes for any design improvements that may have been initiated since inception.
- Actuator assembly will get completely disassembled to piece parts. Aqueous Ultrasonic cleaners are used to thoroughly clean each component before inspection and dimensional checks. Any components found too worn will be replaced with OEM parts. Critical components such as fitted rod and bearings will be dimensionally checked to ensure the component meets the print criteria. A complete seal kit replacement will be installed to ensure integrity of the structure.
- The servo valve will be removed and sent through the same rigorous evaluation, disassembly and test.
- Finally, the assembly will be tested to original specs to ensure the overhauled unit meets all design and performance criteria as if it were new.

Moog Engineering On Call For You

Delivering world-class motion control products and solutions means taking customer support far beyond the initial sale. It requires a dedicated approach to solving your problems, addressing your machine challenges and helping you achieve maximum productivity on a daily basis. In today's competitive manufacturing environment, machine performance plays a significant role in determining your bottom line. Moog Global Support is key to achieving cost-effective machine operation, day in and day out.

Actuator Repair Capabilities

Moog Global Support is designed to keep your critical machines up and running at peak performance with only 100% genuine Moog replacement parts. Only Moog replacement parts can deliver the reliability, versatility and long life that you would expect from a world leader in motion control solutions. Each Moog part delivers essential components with precise dimensions, close tolerances and specific materials specifications. Because we understand the key role our parts play in the overall operation of your machine, we carefully inspect and test each repair to identify only those components that need replacement.

Take The Next Step

Isn't it time you worked with a partner who can offer both the world-class products and collaborative expertise you need to reach the next level of performance? Contact us today and see for yourself the difference the right partner can make.

MOOG GLOBAL SUPPORT®

MOOG TEST PRODUCTS-FOR EVERY TESTING NEED

Moog engineers are always ready to meet your unique application needs with building blocks or complete turnkey systems that include hydraulic or electric test actuators, servo valves, hydraulic service manifolds, test controllers, software and more.

Test Controllers and Software

The Moog Test Controller is a real-time modular control system that can control or collect data from any hydraulic or electromechanical test system. The robust and compact modules have a wide range of transducer inputs and control outputs that can be easily configured for optimum use. The Moog Test Software allows the end user to control and record all of these signals in an easy to use format providing maximum value for many years of reliable usage.

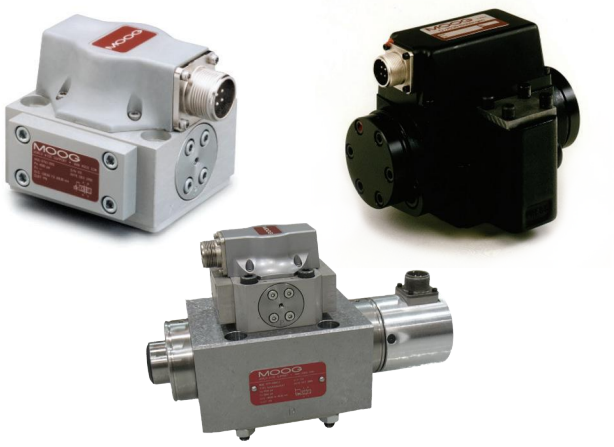
The Moog Aerospace Test Software is the result of close and ongoing cooperation with leading aerospace OEMs and independent test laboratories, as well as research and development centers. This software remains the best-in-class option to successfully run both simple and complex solutions for aerospace static and dynamic tests.

Hydraulic Service Manifolds

The Moog Hydraulic Service Manifold (HSM) provides on/off hydraulic pressure with an adjustable transition from off to high pressure. Filters protect sensitive servo valves and accumulators provide instantaneous flow or pressure damping when needed. Several flow-rating sizes with 1 to 4 station options are available.

Moog Servo Valves

Because we design our renowned Moog Servo Valves - the world standard in performance and durability - you're assured of a system tailored to your exacting requirements.



MORE PRODUCTS. MORE SUPPORT.

Moog designs a range of motion control products to complement those featured in this document. Moog also provides service and support for all of our products. For more information, contact the Moog facility closest to you.

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