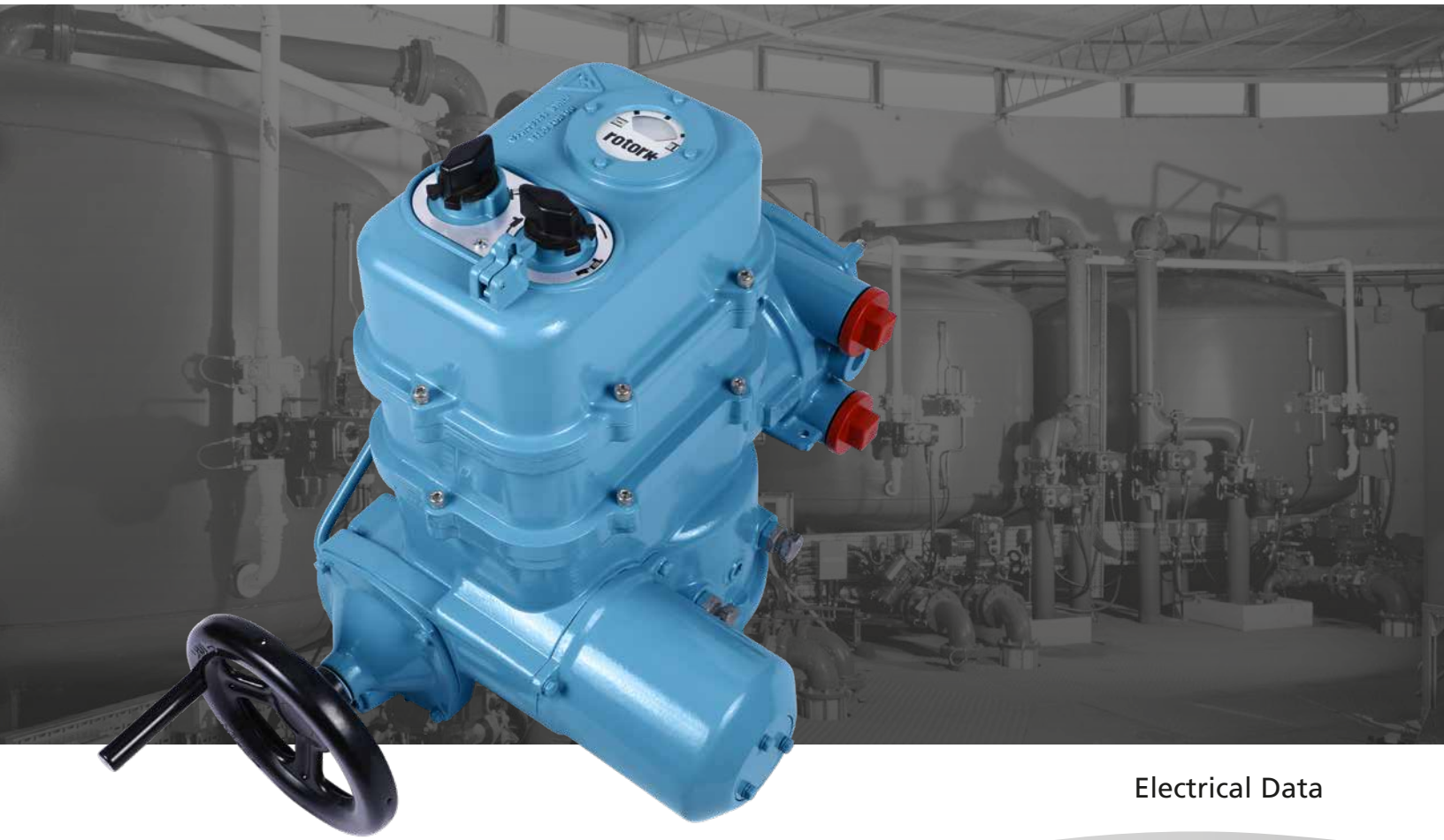
rotork®

Keeping the World Flowing
for Future Generations

Q Range

Electrical Data



Electrical Data

Contents

Rotork is the global market leader in valve automation and flow control. Our products and services are helping organisations around the world to improve efficiency, assure safety and protect the environment.

We strive always for technical excellence, innovation and the highest quality standards in everything we do. As a result, our people and products remain at the forefront of flow control technology.

Uncompromising reliability is a feature of our entire product range, from our flagship electric actuator range through to our pneumatic, hydraulic and electro-hydraulic actuators, as well as instruments, gear boxes and valve accessories.

Rotork is committed to providing first class support to each client throughout the whole life of their plant, from initial site surveys to installation, maintenance, audits and repair. From our network of national and international offices, our engineers work around the clock to maintain our position of trust.

Introduction

This guide is provided to assist in the sizing of actuator power supply cables, circuit protection devices and calculation of electrical diversity. The data provided is averaged from actuators of the same size, speed and voltage as recorded from production test data. As such it is not exact electrical data for individual actuators, however is sufficient for the above sizing calculations.

The data included is for standard duty, 3-phase and 1-phase supplies at the following common voltages only:

Supply Type	50 Hz	60 Hz
3-phase	380	440
	400	460
	415	480
1-phase	110	110
	115	115
	120	120
	220	220
	230	230
	240	240

To quickly access the data for your voltage, click the value in the table above.

Glossary

- **Rated Torque** – the catalogued torque output of the actuator at full load. Represents a torque switch setting for 100%
- **Starting / Stall** – the value during the initial start of output movement or under motor stall conditions
- **Rated Current** – the average current drawn when the actuator is producing the rated catalogue torque
- **Average (nominal) Torque** – corresponds to approximately one third of the rated catalogued torque. This value has been confirmed after decades of valve automation and provides a representative average for load across typical valve strokes

Design Philosophy

Actuators designed for valve automation have bespoke characteristics. Unlike conventional motors, actuators are only short time duty rated. As continuous running is not a requirement with 'isolating' and 'inching' duty valves, actuators are rated for a standard 12 minute nominal operating time with a cyclic duration factor of 20%.

3-phase - Class A & B (EN 15714-2) or S2 - 20% (IEC 60034-1)

1-phase - Class A & B (EN 15714-2) or S2 - 20% (IEC 60034-1) restricted to a maximum of 5 consecutive operations.

Actuator loading is not constant, it can vary from light running through to full rated and even higher when unseating ‘sticky’ valves. Applying traditional motor protection is flawed and can lead to spurious tripping or no protection at all.

Rotork recognises the bespoke nature of actuator design and have therefore incorporated comprehensive protection in the motor and Q Pak control package.

Motor Design

Motors are designed specifically for Q actuators and have the following features:

- Low inertia rotors
- Squirrel cage construction
- Induction windings
- TENV – Totally Enclosed Non-Ventilated
- Class F insulation
- Class B temperature rise
- Embedded thermostats (130 °C)
- Sealed / lubricated for life bearings
- Integral to the actuator

Q range actuators utilise purpose designed motors that are integral to the actuator. As such, these motors do not fall within the scope of IEC 60034 or MG1, however they do meet the applicable requirements of motor design for actuator operation. The motor is designed to reach full speed within 3 cycles of the mains frequency (approximately 60 ms for 50 Hz and 50 ms for 60 Hz). The motor torque / speed characteristic has been selected to fulfil the following requirements:

High Stall Torque in comparison with that required to operate and seat the valve. This is essential in maintaining the rated torque at reduced voltage conditions

Pull out torque available at speed (50-70% of synchronous), which combined with the lost motion drive (hammerblow), allows the motor to reach full speed with maximum available torque before the drive is applied to the valve. This ensures good un-seating of all valve types unless fully jammed.

Introduction

Motor Control Protection

The primary protection device is the torque switch. By direct physical measurement of the actuator output torque using a cam arrangement, effective motor and more importantly valve protection is achieved.

The Q range motor is also protected by multiple thermostats embedded in the motor winding providing over temperature protection if the duty exceeds the actuator rating.

Additionally PHASE ROTATION and LOST PHASE protection is included in all Q Pak actuators.

This combination of torque, thermal and electrical protection eliminates the requirement for traditional motor protection methods and their inherent weaknesses when applied to short time duty, variable load actuators.

Power Supply Cable Sizing

When sizing cables it is important to use the STARTING/STALL figure in this document to make sure the volt drop is limited to a maximum 15% of nominal voltage under full starting conditions.

Protection Device Selection

Due to the unique nature of actuator duty and taking into account the comprehensive control protection included with Q actuators, sizing of fuses, MPCB or OLR devices should be based on protecting the actuator and supply cable under fault conditions.

⚠ Q actuators must be protected with a fuse, MPCB or OLR device to disconnect within 5 to 10 seconds at starting/stall current. Refer to the applicable Electrical Performance Summary table for starting/stall current.

This will reduce the risk of severe motor and supply cable heating under extended stall conditions while preventing spurious trips under normal operation. It should be noted that sizing trip devices in this manner may not be possible while meeting other criteria and is purely designed to protect against extreme fault conditions such as a jammed motor starter when the standard control protection cannot de-energise the motor. All other operating conditions are fully protected by standard Q range protection features.

Motor Options

Extended duty cycles are available with a higher thermostat and Class H insulation.

Frequency Converters and UPS

Frequency converters for variable speed drives are not normally recommended as a suitable supply for Q actuators. Where UPS systems are required for back-up operation, the power supply should have negligible harmonic distortion and should output a true sine wave. In general terms, actuators are designed to operate on power supplies conforming to recognised international standards such as EN 50160:2010.

Tolerances

The following tolerances may be accommodated for short term operation. It is not intended that long term operation is undertaken at supply voltage levels other than the nominal nameplate values of the supplied actuator. In general, the electrical power supply should conform to BS EN 50160:2007 (Voltage characteristics of electricity supplied by public distribution networks) or equivalent.

The volt drop developed on actuator starting must be minimised by ensuring supply capacity and cable are sufficiently sized. Starting volt drop calculation shall be based on the starting/stall currents published.

Voltage Tolerance	+/-10%	Applies to rated torque performance only; not duty cycle and speed
Frequency Tolerance	+/-5%	Applies to rated torque performance only; not duty cycle and speed

Uninterruptable power supplied	The UPS output should conform to recognised supply standards such as BS EN 50160 in respect of waveform, harmonics etc.

Electrical Performance Summary

Click here to return to the voltage table on p3.

3-Phase

Q	Mechanical Data			Electrical Data					
380 V 50 Hz	Travel Time	Rated Torque		Starting / Stall	Rated	Average (nominal) Torque			
		Nm	lbf.ft	A	A	A	kW	Cos Φ	Effy %
Q100	9	136	100	2.50	1.0	0.70	0.09	0.48	37
	18	136	100	1.30	0.7	0.50	0.09	0.45	55
	27	136	100	0.80	0.5	0.40	0.04	0.40	35
Q300	18	406	300	4.20	1.5	1.00	0.18	0.60	42
	36	406	300	2.20	0.9	0.80	0.10	0.50	36
	54	406	300	1.40	0.8	0.45	0.06	0.50	37
Q450	18	610	450	4.20	1.5	1.10	0.18	0.60	42
	36	610	450	2.60	1.0	0.85	0.13	0.48	44
	54	610	450	1.60	0.9	0.70	0.08	0.50	32
Q650	15	900	664	5.80	1.8	1.05	0.27	0.70	55
	30	900	664	2.80	2.0	1.50	0.15	0.50	30
	45	900	664	1.80	0.9	0.70	0.09	0.50	39

Q	Mechanical Data			Electrical Data					
400 V 50 Hz	Travel Time	Rated Torque		Starting / Stall	Rated	Average (nominal) Torque			
		Nm	lbf.ft	A	A	A	kW	Cos Φ	Effy %
Q100	9	136	100	2.20	0.9	0.70	0.09	0.48	37
	18	136	100	1.30	0.6	0.45	0.09	0.50	55
	27	136	100	0.75	0.4	0.30	0.04	0.45	40
Q300	18	406	300	3.80	1.4	0.90	0.18	0.70	40
	36	406	300	2.00	0.8	0.70	0.10	0.55	36
	54	406	300	1.30	0.7	0.50	0.06	0.40	42
Q450	18	610	450	3.80	1.4	1.10	0.18	0.70	38
	36	610	450	2.40	1.1	0.90	0.13	0.48	42
	54	610	450	1.50	0.8	0.60	0.08	0.50	37
Q650	15	900	664	4.60	1.0	0.95	0.27	0.70	58
	30	900	664	3.00	1.8	1.50	0.15	0.45	32
	45	900	664	1.50	0.9	0.70	0.09	0.50	37

Q	Mechanical Data			Electrical Data					
415 V 50 Hz	Travel Time	Rated Torque		Starting / Stall	Rated	Average (nominal) Torque			
		Nm	lbf.ft	A	A	A	kW	Cos Φ	Effy %
Q100	9	136	100	2.20	0.9	0.70	0.09	0.48	37
	18	136	100	1.30	0.6	0.45	0.09	0.50	55
	27	136	100	0.75	0.4	0.30	0.04	0.45	40
Q300	18	406	300	3.80	1.4	0.90	0.18	0.70	40
	36	406	300	2.00	0.8	0.70	0.10	0.55	36
	54	406	300	1.30	0.7	0.50	0.06	0.40	42
Q450	18	610	450	3.80	1.4	1.10	0.18	0.70	38
	36	610	450	2.40	1.1	0.90	0.13	0.48	42
	54	610	450	1.50	0.8	0.60	0.08	0.50	37
Q650	15	900	664	4.60	1.0	0.95	0.27	0.70	56
	30	900	664	3.00	1.8	1.55	0.15	0.45	30
	45	900	664	1.50	0.9	0.70	0.09	0.50	37

Values are subject to change without notice. Due to production tolerance variation, the electrical values shown are averages compiled from actuator production test data. Values are therefore provided for guidance only. Individual production test certificates are available on request (nominal load data not included). Rotork underwrite rated torque output only (specified tolerance -0/+10%).

Electrical Performance Summary

Click here to return to the voltage table on p3.

3-Phase

Q	Mechanical Data			Electrical Data					
440 V 60 Hz	Travel Time	Rated Torque		Starting / Stall	Rated	Average (nominal) Torque			
		Nm	lbf.ft	A	A	A	kW	Cos Φ	Effy %
Q100	8	136	100	3.00	1.00	0.80	0.10	0.48	36
	15	136	100	1.80	0.75	0.50	0.10	0.50	55
	23	136	100	0.80	0.50	0.35	0.05	0.45	40
Q300	15	406	300	4.20	1.50	1.10	0.20	0.60	42
	30	406	300	2.20	0.80	0.80	0.11	0.50	38
	45	406	300	1.40	0.75	0.55	0.08	0.50	40
Q450	15	610	450	4.20	1.50	1.10	0.20	0.60	42
	30	610	450	2.50	1.20	1.00	0.15	0.48	42
	45	610	450	1.50	1.20	0.70	0.10	0.50	40
Q650	13	900	664	6.80	1.20	0.90	0.33	0.70	56
	25	900	664	2.60	1.40	0.90	0.18	0.55	40
	38	900	664	2.10	1.00	0.70	0.11	0.50	34

Q	Mechanical Data			Electrical Data					
460 V 60 Hz	Travel Time	Rated Torque		Starting / Stall	Rated	Average (nominal) Torque			
		Nm	lbf.ft	A	A	A	kW	Cos Φ	Effy %
Q100	8	136	100	2.60	1.00	0.80	0.10	0.48	36
	15	136	100	1.40	0.70	0.50	0.10	0.50	55
	23	136	100	0.80	0.50	0.35	0.05	0.45	40
Q300	15	406	300	4.50	1.50	1.20	0.20	0.60	39
	30	406	300	2.20	0.90	0.80	0.11	0.50	38
	45	406	300	1.40	0.75	0.55	0.08	0.50	40
Q450	15	610	450	4.50	1.50	1.20	0.20	0.60	39
	30	610	450	2.60	1.30	1.00	0.15	0.48	42
	45	610	450	1.50	0.90	0.60	0.10	0.50	45
Q650	13	900	664	7.00	1.75	1.25	0.33	0.65	50
	25	900	664	2.60	1.20	1.05	0.18	0.55	40
	38	900	664	2.10	0.90	0.90	0.11	0.50	30

Q	Mechanical Data			Electrical Data					
480 V 60 Hz	Travel Time	Rated Torque		Starting / Stall	Rated	Average (nominal) Torque			
		Nm	lbf.ft	A	A	A	kW	Cos Φ	Effy %
Q100	8	136	100	2.40	0.90	0.80	0.10	0.48	36
	15	136	100	1.40	0.60	0.50	0.10	0.50	55
	23	136	100	0.80	0.40	0.35	0.05	0.45	40
Q300	15	406	300	4.20	1.40	1.00	0.20	0.70	40
	30	406	300	2.20	0.80	0.80	0.11	0.50	38
	45	406	300	1.40	0.70	0.55	0.08	0.50	40
Q450	15	610	450	4.20	1.40	1.00	0.20	0.60	45
	30	610	450	2.60	1.10	1.10	0.15	0.48	40
	45	610	450	1.70	0.80	0.65	0.10	0.50	42
Q650	13	900	664	6.00	1.00	1.10	0.33	0.70	52
	25	900	664	3.60	2.00	1.65	0.18	0.45	30
	38	900	664	2.00	0.95	0.86	0.11	0.50	32

Values are subject to change without notice. Due to production tolerance variation, the electrical values shown are averages compiled from actuator production test data. Values are therefore provided for guidance only. Individual production test certificates are available on request (nominal load data not included). Rotork underwrite rated torque output only (specified tolerance -0/+10%).

Electrical Performance Summary

Click here to return to the voltage table on p3.

1-Phase

Q	Mechanical Data			Electrical Data			
110 – 120 V 50 Hz	Travel Time	Rated Torque		Starting / Stall	Average (nominal) Torque		
		Nm	lbf.ft	A	A	kW	Cos Φ
Q100	9	136	100	7.0	4.9	0.21	0.90
	18	136	100	3.2	2.3	0.10	0.97
	27	136	100	2.7	2.6	0.07	0.99
Q300	18	406	300	8.6	5.3	0.27	0.90
	36	406	300	6.0	3.1	0.14	0.95
	54	406	300	2.5	1.8	0.08	0.98

Q	Mechanical Data			Electrical Data			
220 – 240 V 50 Hz	Travel Time	Rated Torque		Starting / Stall	Average (nominal) Torque		
		Nm	lbf.ft	A	A	kW	Cos Φ
Q100	9	136	100	3.6	2.6	0.21	0.90
	18	136	100	1.7	1.2	0.10	0.95
	27	136	100	1.4	1.3	0.07	0.99
Q300	18	406	300	4.7	2.6	0.27	0.90
	36	406	300	2.9	1.6	0.14	0.95
	54	406	300	1.8	1.5	0.08	0.75

Q	Mechanical Data			Electrical Data			
110 – 120 V 60 Hz	Travel Time	Rated Torque		Starting / Stall	Average (nominal) Torque		
		Nm	lbf.ft	A	A	kW	Cos Φ
Q100	8	136	100	7.0	4.9	0.21	0.90
	15	136	100	3.2	2.3	0.10	0.97
	23	136	100	2.7	2.6	0.07	0.99
Q300	15	406	300	8.6	5.3	0.27	0.90
	30	406	300	6.0	3.1	0.14	0.95
	45	406	300	3.2	2.8	0.08	0.80

Q	Mechanical Data			Electrical Data			
220 – 240 V 60 Hz	Travel Time	Rated Torque		Starting / Stall	Average (nominal) Torque		
		Nm	lbf.ft	A	A	kW	Cos Φ
Q100	8	136	100	3.6	3.0	0.21	0.90
	15	136	100	1.7	1.6	0.10	0.80
	23	136	100	1.4	1.3	0.07	0.99
Q300	15	406	300	5.0	4.7	0.27	0.75
	30	406	300	2.9	1.6	0.14	0.95
	45	406	300	2.4	1.9	0.08	0.75

Values are subject to change without notice. Due to production tolerance variation, the electrical values shown are averages compiled from actuator production test data. Values are therefore provided for guidance only. Individual production test certificates are available on request (nominal load data not included). Rotork underwrite rated torque output only (specified tolerance -0/+10%).

rotork®

www.**rotork**.com

A full listing of our worldwide sales and service network is available on our website.

Rotork plc
Brassmill Lane, Bath, UK
tel +44 (0)1225 733200
email mail@rotork.com

PUB007-006-00
Issue 01/21