

POWERJACKS

PRECISION ACTUATION

Warranty

Formulae

Engineers
Reference
Guide

Enclosure
Ratings

Key
Tables

Conversion
Factors

Property
Tables

Nut & Bolts

**ENGINEERS REFERENCE
USEFUL INFORMATION**

POWERJACKS

USEFUL INFORMATION FOR ENGINEERS



Capability



OUR EXPERTISE HAS BEEN BUILT ON A HISTORY OF MORE THAN 100 YEARS OF ENGINEERING, CRAFTSMANSHIP, VISIONARY DESIGN, QUALITY MANUFACTURE AND CUSTOMER CARE.



Power Jacks is a manufacturing/engineering company specialising in the design and manufacture of actuation, lifting and positioning solutions for applications in Industrial Automation, Energy, Defence, Medical, Transport, and the Civil Engineering sectors.

Headquartered near Aberdeen in the UK, the company is the UK's largest screw jack manufacturing facility, that uses the latest engineering technologies to deliver quality products (BS EN ISO 9001) that offer reliability, performance and economy.

Power Jacks deliver this high quality service in a safe (OHSAS 18001) and environmentally friendly (ISO 14001) working environment thanks to the highly trained, flexible and motivated teams that work throughout the business driving the company to higher levels of performance.

We know our customers demand our engineering expertise to help find a solution for their applications. We take pride in designing and delivering the best solution using standard or special designs that help improve your business.

Our Vision is to become the partner of choice for our products globally

Our Mission is to provide high quality lifting & positioning solutions.

Global Reach

Power Jacks has local representation in 26 countries and supplies its products to more than 80 countries worldwide.



A global reach with a local service as we work closely with our customers to ensure the best solution for all their Electro-Mechanical solution applications.

- Headquarters & Factory
- Local Power Jacks Sales Offices
- Local Representative

| Length | m | mm | inch | ft |
|--------|--------|-------|---------|-----------------------|
| 1 m | 1 | 1000 | 8mm | 3.2808 |
| 1 mm | 0.001 | 1 | 0.03937 | 32.8×10^{-3} |
| 1 inch | 0.0254 | 25.4 | 1 | 0.0833 |
| 1 ft | 0.3048 | 304.8 | 12 | 1 |

| Mass | kg | Tonne | lb | Ton (Short) | Ton |
|-----------------|-----------|------------------------|--------|-------------------------|------------------------|
| 1 kg | 1 | 0.001 | 2.2046 | 1.1023×10^{-3} | 9.842×10^{-4} |
| 1 Tonne | 1000 | 1 | 2204.6 | 1.1023 | 0.9842 |
| 1 lb | 0.4535937 | 4.536×10^{-4} | 1 | 5×10^{-4} | 4.464×10^{-4} |
| 1 Tonne (Short) | 907.185 | 0.907185 | 2000 | 1 | 0.8929 |
| 1 Ton | 1016.05 | 1.016 | 2240 | 1.120 | 1 |

| Force / Weight | N | kgf | kp | lbf |
|----------------|---------|------------|--------|----------|
| 1 N | 1 | 0.1019716 | 0.120 | 0.224809 |
| 1 kgf | 9.80665 | 1 | 1 | 2.2046 |
| 1 kp | 9.80665 | 1 | 1 | 2.2046 |
| 1 lbf | 4.44822 | 0.45359237 | 0.4536 | 1 |

| Speed | N | mm/s | ft/s | in/s |
|--------|--------|-------|-----------------------|---------|
| 1 m/s | 1 | 1000 | 3.2808 | 39.37 |
| 1 mm/s | 0.001 | 1 | 3.28×10^{-3} | 0.03937 |
| 1 ft/s | 0.3048 | 304.8 | 1 | 12 |
| 1 in/s | 0.0254 | 25.4 | 0.0833 | 1 |

| Torque / Work | Nm | kgf.cm | lbf.in | lbf.ft |
|---------------|--------------------------|----------|--------|---------|
| 1 Nm | 1 | 10.19716 | 8.8507 | 0.73756 |
| 1 kfg.cm | 9.80665×10^{-2} | 1 | 0.8679 | 0.07233 |
| 1 lbf.in | 0.1129848 | 1.1521 | 1 | 0.08333 |
| 1 lbf.ft | 1.35582 | 13.825 | 12 | 1 |

| Power | kW | Nm/min | kgf.m/s | hp | lbf.ft/min |
|--------------|------------------------|--------|-------------------------|------------------------|------------|
| 1 kW | 1 | 60000 | 10.20 | 1.34 | 44220 |
| 1 Nm/min | 1.667×10^{-4} | 1 | 1.699×10^{-3} | 2.235×10^{-5} | 0.7374 |
| 1 kgf.m/s | 9.807×10^{-3} | 588.6 | 1 | 0.01315 | 433.73 |
| 1 hp | 0.7457 | 44741 | 76.04 | 1 | 33000 |
| 1 lbf.ft/min | 2.261×10^{-5} | 1.3566 | 2.3056×10^{-3} | 3.03×10^{-5} | 1 |

| Inertia | kg.m ² (mr ²) | kpms ² | lbf.ft ² (WK ²) | lbf.in ² (WK ²) |
|--|--------------------------------------|-----------------------|--|--|
| kg.m ² (mr ²) | 1 | 0.10197 | 23.73 | 3417.2 |
| 1 kpms ² | 9.807 | 1 | 232.6 | 33488 |
| 1 lbf.ft ² (WK ²) | 0.0421 | 4.30×10^{-3} | 1 | 144 |
| 1 lbf.in ² (WK ²) | 2.9264×10^{-4} | 0.6192 | 6.944×10^{-3} | 1 |

| Stress / Pressure | MPa [N/mm ²] | N/m ² | kg/cm ² | lbf/inch ² | lbf/ft ² |
|----------------------------|--------------------------|--------------------|------------------------|-----------------------|------------------------|
| 1 MPa [N/mm ²] | 1 | 1×10^{-6} | 10.2 | 145.039 | 20885.6 |
| 1 N/m ² | 1×10^{-6} | 1 | 10.2×10^{-6} | 145×10^{-6} | 20.88×10^{-6} |
| 1 kg/cm ² | 9.807×10^{-2} | 9.81×10^3 | 1 | 14.2233 | 2.05×10^3 |
| 1 lbf/inch ² | 9.8947×10^{-3} | 6.89×10^3 | 0.070307 | 1 | 144 |
| 1 lbg/ft ² | 4.7879×10^{-5} | 47.88026 | 0.488×10^{-3} | 6.94×10^{-3} | 1 |

| Temperature | |
|-------------|--|
| T °F | $(T \text{ °C} \times 1.8) + 32^\circ$ |
| T °C | $(T \text{ °F} - 32) / 1.8$ |

IEC Ratings

| 1st Digit : Solid Ingress | | 2nd Digit : Liquid Ingress | |
|---------------------------|---|----------------------------|---|
| 0 | No special protection | 0 | No special protection |
| 1 | A large surface of the body, such as hand (but no protection against deliberate acces.) Solid objects >50 mm diameter. | 1 | Dripping water (vertically falling drops). |
| 2 | Fingers or similar objects not exceeding 80mm in length. Solid objects >12mm in diameter. | 2 | Vertically dripping water when the enclosure is tilted at any angle up to 15° from its normal position. |
| 3 | Tools, wires, etc. of diameter or thickness >2.5mm. Solid objects >1mm diameter. | 3 | Water falling as a spray at an angle of 60° from the vertical. |
| 4 | Wires or strips of thickness >1mm. Solid objects >1mm diameter. | 4 | Water splashed against the enclosure from any direction. |
| 5 | Ingress of dust is not totally prevented, but dust does not enter in sufficient quantity to interfere with satisfactory operation of the equipment. | 5 | Water projected by a nozzle against the enclosure. |
| 6 | No ingress of dust. | 6 | Water from heavy seas or projected in powerful jets. |
| | | 7 | Ingress of water in a harmful quantity not possible when the enclosure is immersed under defined conditions of pressure and time. |
| | | 8 | Submersible under defined conditions of pressure and time. |

NEMA and IEC Equivalent Enclosures

Since the IEC degree of protection for enclosed equipment is defined differently from NEMA type enclosure protection, and methods of test are different, exact correlation between IEC IP-type designations and NEMA types is not possible. It is possible to make rough comparisons, which may result in certain applications. The common NEMA type designations compare with IEC designations as follows:

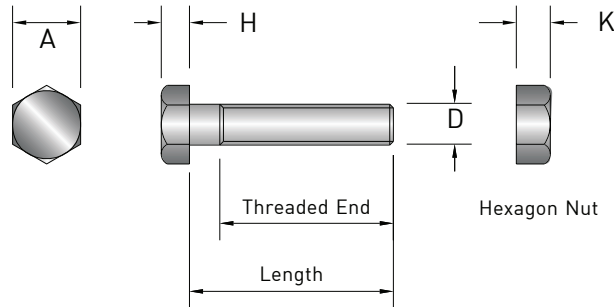
| NEMA Type | | Nearest IEC Equivalent | |
|-----------|---|------------------------|--|
| NEMA 1 | General protection of people from live parts. Protection against falling dirt. Test: 1/8" to 1/2" (3.175 to 12.7mm) rod entry test and rust resistance tests. | IP2X (1) | Protected against solid objects greater than 12mm. Test: Metallic test finger and 12mm sphere tests. No IEC rust resistance test. |
| NEMA 3 | Dust-tight and sleet resistant. Test: Rain, dust, external icing and rust resistance test. | IP54 | Dust protected. Protected against splashing water. Test: Dust and oscillating sprinkler tests. No IEC rust resistance test. |
| NEMA 3R | Rain-proof and sleet resistant. Test: Rod entry 1/8" to 1/4" (3.175 to 6.35mm), rain, external icing and rust resistance tests. | IP34 | Protected against solid objects greater than 2.5mm. Protected against splashing water. Test: 2.5mm rod and oscillating sprinkler tests. No IEC rust resistance or icing tests. |
| NEMA 4 | Water-tight and dust-tight. Test: Hosedown, rust-resistance and external icing tests. | IP65 | Dust-tight and protected against water jets. Test: Dust and spray nozzle tests. no rust resistance or external icing test. |
| NEMA 4X | Water-tight, dust-tight and corrosion resistance. Test: Hosedown, corrosion resistance and external icing tests. | IPW65 (2) | Dust-tight and protected against water jets. Test: Dust and spray nozzle tests. No rust resistance or external icing test. |
| NEMA 7 | Hazardous gas. | - | No IEC equivalent. |
| NEMA 9 | Hardous dust. | - | No IEC equivalent. |
| NEMA 12 | Dust-tight and drip-tight. Test: Drip, dust and rust resistance tests. | IP61 | Dust-tight and protected against dripping water. Test: Dust and rain simulator tests. No IEC rust resistance test. |
| NEMA 18 | Oil tight and dust tight. Test: Oil-tightness and rust-resistance tests. | IP6X (1) | Dust-tight. Test: Dust test. No IEC oil-tightness or rust resistance tests. |

Note

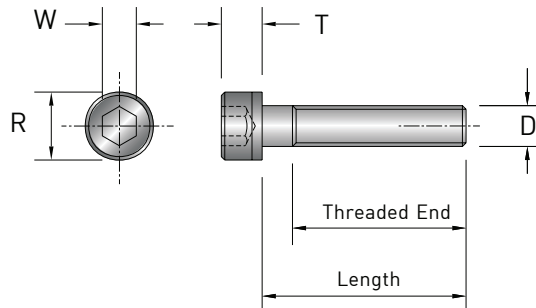
1. When only one characteristic numeral is used the second numeral is replaced by an 'X'.
2. 'W' inserted after the 'IP' indicates suitable for a specified weather condition (conditions and features specified by manufacturer).

| Thread Size | Pitch | Hexagon Bolts & Nuts | | | Sockets Head Cap Screw | | |
|-------------|-------|----------------------|--------|------|------------------------|------|------|
| D | | A | H | K | R | T | W |
| M3 | 0.50 | 5.5 | 2.125 | 2.4 | 5.5 | 3.0 | 2.5 |
| M4 | 0.70 | 7.0 | 2.925 | 3.2 | 7.0 | 4.0 | 3.0 |
| M5 | 0.80 | 8.0 | 3.650 | 4.0 | 8.5 | 5.00 | 4.0 |
| M6 | 1.00 | 10.0 | 4.150 | 5.0 | 10.0 | 6.0 | 5.0 |
| M8 | 1.25 | 13.0 | 5.650 | 6.5 | 13.0 | 8.0 | 6.0 |
| M10 | 1.50 | 17.0 | 7.180 | 8.0 | 16.0 | 10.0 | 8.0 |
| M12 | 1.75 | 19.0 | 8.180 | 10.0 | 18.0 | 12.0 | 10.0 |
| (M14) | 2.00 | 22.0 | 9.180 | 11.0 | 21.0 | 14.0 | 12.0 |
| M16 | 2.00 | 24.0 | 10.180 | 13.0 | 24.0 | 16.0 | 14.0 |
| (M18) | 2.50 | 27.0 | 12.215 | 15.0 | 27.0 | 18.0 | 14.0 |
| M20 | 2.50 | 30.0 | 13.215 | 16.0 | 30.0 | 20.0 | 17.0 |
| (M22) | 2.50 | 32.0 | 14.215 | 18.0 | 33.0 | 22.0 | 17.0 |
| M24 | 3.00 | 36.0 | 15.215 | 19.0 | 36.0 | 24.0 | 19.0 |
| (M27) | 3.00 | 41.0 | 17.215 | 22.0 | 40.0 | 27.0 | 19.0 |
| M30 | 3.50 | 46.0 | 19.620 | 24.0 | 45.0 | 30.0 | 22.0 |
| (M33) | 3.50 | 50.0 | 21.260 | 26.0 | 50.0 | 33.0 | 24.0 |
| M36 | 4.00 | 55.0 | 23.260 | 29.0 | 54.0 | 36.0 | 27.0 |
| (M39) | 4.00 | 60.0 | 25.260 | 31.0 | - | - | - |
| M42 | 4.50 | 65.0 | 26.260 | 34.0 | 63.0 | 42.0 | 32.0 |

Hexagon Bolt



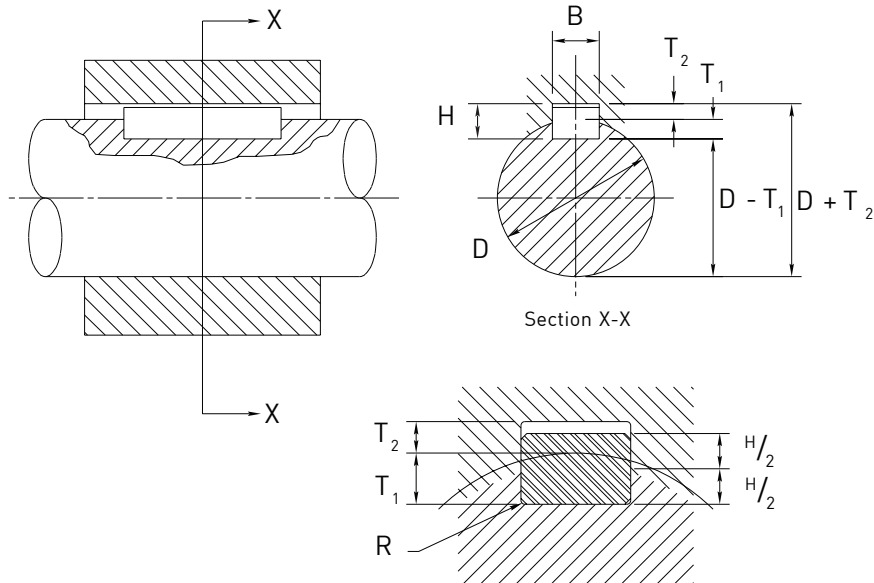
Socket Head Cap Screw



Note

1. All dimensions in millimetres.
2. Sizes in brackets are non-preferred standards.
3. All dimensions are maximum sizes.

Enlarged Detail of Key and Keyways



| Symbol | | Key B x H width x thick-ness | Keyway | | | | | | | | | | | |
|--------------------------|------|--|-----------|----------------------------|-----------|--|--------|--------|-----------|------|---------|------|-----------|------|
| Nominal Diameter D | | | Nom | Width, B | | | | | Depth | | | | Radius, R | |
| | | | | Tolerance for class of fit | | | | | Shaft, T1 | | Hub, T2 | | | |
| Over | Incl | Shaft (H9) | Hub (D10) | Shaft (N9) | Hub (Js9) | Close and Interference Shaft and Hub (P9) | Nom. | Tol. | Nom. | Tol. | Max. | Min. | | |
| 6 | 8 | 2 x 2 | 2 | +0.025 | +0.060 | -0.004 | +0.012 | -0.006 | 1.2 | +0.1 | 1.0 | +0.1 | 0.16 | 0.08 |
| 8 | 10 | 3 x 3 | 3 | 0 | +0.020 | -0.029 | -0.012 | -0.031 | 1.8 | 0 | 1.4 | 0 | | |
| 10 | 12 | 4 x 4 | 4 | +0.030 | +0.078 | 0 | +0.015 | -0.012 | 2.5 | | 1.8 | | | |
| 12 | 17 | 5 x 5 | 5 | 0 | +0.080 | -0.030 | -0.015 | -0.042 | 3.0 | | 2.3 | | 0.25 | 0.16 |
| 17 | 22 | 6 x 6 | 6 | | | | | | 3.5 | | 2.8 | | | |
| 22 | 30 | 8 x 7 | 8 | +0.036 | +0.095 | 0 | +0.018 | -0.015 | 4.0 | +0.2 | 3.3 | +0.2 | | |
| 30 | 38 | 10 x 8 | 10 | 0 | +0.040 | -0.036 | -0.018 | -0.051 | 5.0 | 0 | 3.3 | 0 | 0.40 | 0.25 |
| 38 | 44 | 12 x 8 | 12 | | | | | | 5.0 | | 3.3 | | | |
| 44 | 50 | 14 x 9 | 14 | +0.043 | +0.120 | 0 | +0.021 | -0.018 | 5.5 | | 3.8 | | | |
| 50 | 58 | 16 x 10 | 16 | 0 | +0.050 | -0.043 | -0.021 | -0.061 | 6.0 | | 4.3 | | | |
| 58 | 65 | 18 x 11 | 18 | | | | | | 7.0 | | 4.4 | | | |
| 65 | 75 | 20 x 12 | 20 | | | | | | 7.5 | | 4.9 | | 0.60 | 0.40 |
| 75 | 85 | 22 x 14 | 22 | +0.052 | +0.149 | 0 | +0.026 | -0.022 | 9.0 | | 5.4 | | | |
| 85 | 95 | 25 x 14 | 25 | 0 | +0.065 | -0.052 | -0.026 | -0.074 | 9.0 | | 5.4 | | | |
| 95 | 110 | 28 x 16 | 28 | | | | | | 10.0 | | 6.4 | | | |
| 110 | 130 | 32 x 18 | 32 | | | | | | 11.0 | | 7.4 | | | |
| 130 | 150 | 36 x 20 | 36 | +0.062 | +0.180 | 0 | +0.031 | -0.022 | 12.0 | +0.3 | 8.4 | +0.3 | 1.00 | 0.70 |
| 150 | 170 | 40 x 22 | 40 | 0 | +0.080 | -0.062 | -0.031 | -0.088 | 13.0 | 0 | 9.4 | 0 | | |
| 170 | 200 | 45 x 25 | 45 | | | | | | 13.0 | | 10.4 | | | |

Note

For full range and further information refer BS 4235: Pt 1: 1972

Physical Property Values, at 20°C

| Material | Carbon Steel | Aluminium Alloys | Brass 65/35 | Copper | Stainless Steel |
|---|--------------|------------------|-------------|--------|-----------------|
| Density, ρ (kg/m ³) | 7860 | 2710 | 8450 | 8910 | 7750 |
| Young's Modulus, E (GN/m ²) | 207 | 710 | 105 | 119 | 190 |
| Shear Modulus, G (GN/m ²) | 79.3 | 26.2 | 38 | 44.7 | 73.1 |
| Bulk Modulus, K (GN/m ²) | 172 | 57.5 | 115 | 130 | 178 |
| Poisson's Ratio, ν | 0.292 | 0.334 | 0.35 | 0.326 | 0.305 |
| Coefficient of Thermal Expansion $\times 10^{-6}/K$ | 12 | 22 | 19 | 17 | 14 |
| Specific Heat J/kg K | 460 | 920 | 420 | 420 | 460 |

Note

Values given are representative. Exact values may vary with composition and processing, sometimes greatly.

Standard SI Prefixes * †

| Name | System | Factor |
|---------|--------|---|
| exa | E | 1 000 000 000 000 000 000 = 10 ¹⁸ |
| peta | P | 1 000 000 000 000 000 = 10 ¹⁵ |
| tera | T | 1 000 000 000 000 = 10 ¹² |
| giga | G | 1 000 000 000 = 10 ⁹ |
| mega | M | 1 000 000 = 10 ⁶ |
| kilo | k | 1 000 = 10 ³ |
| hecto ‡ | h | 100 = 10 ² |
| deca ‡ | da | 10 = 10 ¹ |
| deci ‡ | d | 0.1 = 10 ⁻¹ |
| centi ‡ | c | 0.01 = 10 ⁻² |
| milli | m | 0.001 = 10 ⁻³ |
| micro | μ | 0.000 001 = 10 ⁻⁶ |
| nano | n | 0.000 000 001 = 10 ⁻⁹ |
| pico | p | 0.000 000 000 001 = 10 ⁻¹² |
| femto | f | 0.000 000 000 000 001 = 10 ⁻¹⁵ |
| atto | a | 0.000 000 000 000 000 001 = 10 ⁻¹⁸ |

* If possible use multiple and submultiple prefixes in steps of 1000.

† Spaces are used in SI instead of commas to group numbers to avoid confusion with the practise in some European countries of using commas for decimal points.

‡ Not recommended but sometimes encountered.

POWERJACKS

PRECISION ACTUATION

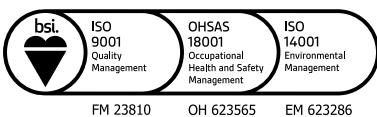
Power Jacks specialises in the design and manufacture of precision linear actuation, positioning and lifting equipment.

Our products are supplied globally across many sectors including Industrial Automation, Energy, Transport, Defence and Civil.

Power Jacks Ltd
Kingshill Commercial Park
Prospect Road, Westhill
Aberdeenshire AB32 6FP
Scotland (UK)
Tel: +44 (0)1224 968968

www.powerjacks.com
sales@powerjacks.com

PJBSC-ER-EN-02



All information in this document is subject to change without notice. All rights reserved by Power Jacks Limited. May not be copied in whole or in part. ©Power Jacks Limited 2018, Aberdeenshire, Scotland, United Kingdom.

Follow Us  Facebook  LinkedIn  Twitter