4B Components Ltd.

HOW-TO...
Choosing the Right Elevator Bolt

Elevator bolts are characterized by their oversized flat, thin, countersunk head. When used to attach elevator buckets to belting, the thin head lies flush with the belt surface so not to interfere with the pulley. Which bolt style to choose depends on the application and the preferences of the installer.

There are three common materials associated with elevator bolts: plain carbon steel, zinc plated carbon steel and stainless steel. Plain carbon steel bolts are made from low carbon steel with a natural black color and should have a light oil coating applied to retard oxidation. Zinc plated elevator bolts are made from the same low carbon steel but the zinc plating offers better oxidation resistance. Because stainless steel elevator bolts are impervious to oxidation they are often used in high heat, food grade or caustic applications (such as agricultural fertilizer). When used in a bucket elevator, SAE J429 Grade 2 or greater bolts are necessary, as they offer the required strength for the application.

(Fig. 1)

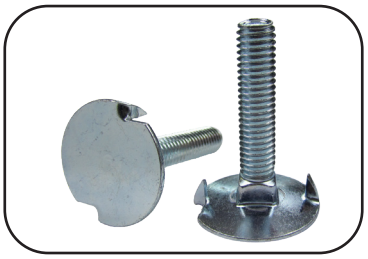
Norway No. 1 Style

The designation Norway does not refer to the country but instead to the type of steel originally used in the manufacture of these rugged bolts (Fig. 1). Its proper name is the “No.1 Flat Countersunk Head” elevator bolt. Norway bolts are the most common and the least expensive of the standard styles. Counter rotation resistance is provided by the square neck under the flat head. When the square neck is forced into the round hole on a belt, the four corners grab to offer modest spin impedance. Norway bolts are often assembled with a hex nut, spring lock washer and flat washer on the inside of the elevator bucket. Retightening these assemblies over time is essential as they may loosen due to vibration. In a new installation the elevator belt tends to stretch and become thinner over time. Because of this the tension on the spring lock washer diminishes and subsequently so does its effectiveness in holding the hex nut tightly in place. Therefore, this attachment system is prone to loosening.

(Fig. 2)

No. 3 Eclipse-Reliance

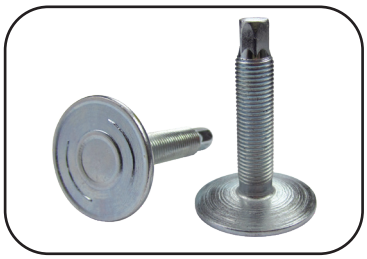
A variation on the flat countersunk head elevator bolt is the ribbed and slotted head elevator bolt. Commonly called a No. 3, an Eclipse or a Reliance bolt (Fig. 2), it has a six pointed radial star beneath its smaller head. The protruding ridges of the star offer some spinning resistance and the slot in the head is for a flat tipped screwdriver. Recommended for smaller diameter pulley applications its smaller head can more easily travel around smaller diameter pulleys.



(Fig. 3)

Fanged Style

More costly than the Norway bolt, the fanged elevator bolt has two sharp teeth that penetrate the cover and carcass of the elevator belt (Fig. 3). The teeth lock the bolt head in place to keep it from spinning. Because it will not spin freely, it is possible to use a resistance lock nut such as a nylon inserted lock (nylock) nut with this bolt style. This assembly system is considered superior to the typical Norway system because the nylock nut has a much lower likelihood of coming loose due to vibration. If the length of the fangs is greater than the thickness of the elevator belt, a non-fanged bolt style should be used instead.



(Fig. 4)

Easifit

The Easifit bolt is unique in that it employs a hexagon tip (Fig 4) to deliver spin resistance. Special installation tools lock onto the hexagon tip to keep the bolt from spinning as a nylock nut is tightened down the shaft. Bolt rotation is eliminated without the use of penetrating fangs. This system is especially popular for repair jobs where the bolt holes have become elongated negating the effectiveness of the Norway's square shoulder. The Easifit bolt allows the entire fastening operation to be conducted from the exposed front of the belt and inside the buckets.

(Fig. 5)

Reference 70

The Reference 70 (Ref 70) style elevator bolt, when coupled with the special oval mating washer, offers the greatest belt pull-through resistance available of any bolt style (Fig. 5). This combination is ideal for heavy-duty industrial applications or for overlap splices where extra force is exerted on the bolts. Due to the large diameter of the oval washer, application must be on pulleys over 20-inches in diameter and special care should be taken when used with steel web carcass belts.

(Fig. 6)

Euro Bolt (DIN 15237)

The DIN 15237 bolt derives its name from the 1980 Deutsche Institute für Normung (DIN) Standard No.15237 covering "continuous mechanical handling equipment; seating screws and cupped washers for the attachment of components to belts". This fastening system is comprised two components: an elevator bolt with two prongs under the head and a mating cupped washer (Fig. 6). Popular throughout Europe for the last 40 years, this fastening system was originally specified in metric thread only and intended for the attachment of stamped steel elevator buckets incorporating dimpled bolt holes. The bucket's dimpled bolt hole is intended to accommodate the similarly domed bottom of the bolt head. Because of this domed area under the bolt head, these bolts are not recommended for attaching flat backed plastic buckets, especially on thinner belts.

(Fig. 7)

Spacers

Spacers used between the elevator belt and bucket are typically available in polyethylene, neoprene and leather (Fig. 7). They allow material to freely flow back down behind the bucket. They can also protect the belt from excessive heat which might be transferred by the bucket thereby extending the life of the elevator belt. Sometimes spacers are employed when an elevator bucket has two parallel rows of bolt holes as used in many industrial applications. This allows the bucket to better conform to the round surface of the pulley as it passes around it.

(Fig. 8)

Washers

Stamped metal washers are installed on the inside of the elevator bucket in-between the bucket wall and the spring lock washer or nylock nut. Larger “fender” style washers are recommended for plastic buckets as they distribute the tightening pressure over a greater surface area of the bucket, offering greater protection should the bucket be subject to an impact.

(Fig. 9)

Nuts

There are four common nut styles that are used with elevator bolts: hex nut, nylon inserted lock nut (nylock), large flange serrated nut (whiz nut) and all metal lock nut. The hex nut is the most common and least expensive. It should be used with a lock washer to keep it from unthreading due to vibration. Nylock nuts are much more secure than hex nuts but should only be used with non-rotational bolts such as fanged and Easi-Fit. Nylon is not suited for applications in excess of 300Deg F as it will soften and lose its integrity. For high heat applications all metal lock nuts are a better choice. Neither the nylock nut nor the all metal lock nut are reusable. The whiz nut has serrations under a lip or flange designed to dig into the material of contact and keep the nut from loosening. Although popular for its ease of use, for attaching buckets to belting the whiz nut is prone to coming loose. Plastic is not a long lasting durable locking surface.

Installation Tips

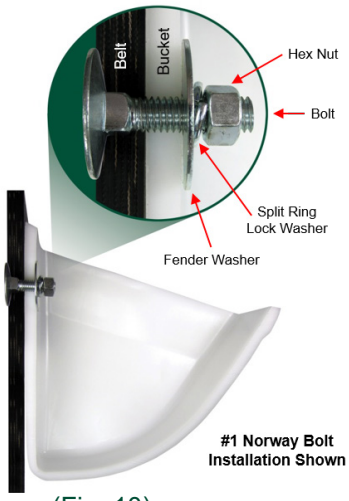
The head of the elevator bolt is installed on the pulley side of the elevator belt with the washers and nuts on the inside of the elevator bucket (Fig. 10). Do not use a pneumatic or battery operated wrench without torque control to install the nuts on elevator bolts. An ideal installation will result in the elevator bolt head fitting snuggly just below the surface of the elevator belt (Fig. 11) IFI standards for bolt torque (Table 1) can be used as a general guide, but may need to be higher to properly seat the bolt head. Each assembly system may have its own unknown coefficients of friction and properties of resistance depending on the coating or other contaminates. Elevator bolts, especially stainless steel, vary in hardness which affects the torque required. Using a lubricant should be considered. Over tightening of elevator bolts can result in fractures to the back of a plastic elevator bucket. If the bolt head is seated too far below the surface of the elevator belt, a “hill” can form on the belt between the bolt heads causing premature wear to the belt

For fanged bolts, align the fangs in a horizontal line across the width of the belt (Fig. 12). Sometimes it helps to “set” the fangs into the belt cover by tapping them with a mallet. Once the bolt is tightened, the fangs will draw up into the belt so that the head can properly seat. Fanged bolts may have trouble penetrating unusually hard belts, especially in cold temperatures.

The proper bolt length is the sum of the thicknesses of the belt, the spacer, the bucket back wall, the washers and the nut, plus an additional quarter inch. After initial installation, the elevator belt system should be run for at least four hours after which the bolts should be re-tightened. Periodic inspections should be carried out over the life of the elevator belt system to insure proper operation of the equipment.

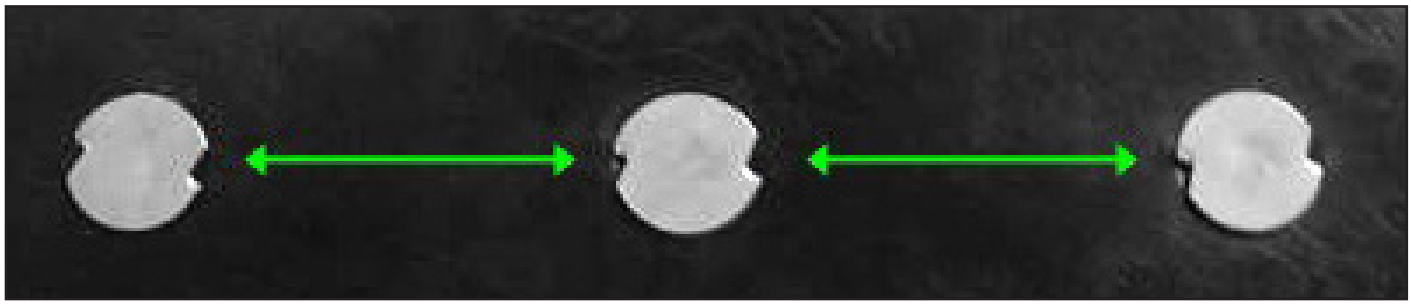
MAXIMUM RECOMMENDED TORQUE FOR 4B ELEVATOR BOLTS SAE GRADE 2 OR 302 STAINLESS STEEL			
Bolt Diameter	**in. lbs**	**ft. lbs.**	**Nm**
1/4”	72	6	8
5/16”	156	13	18
3/8”	276	23	31
1/2”	684	57	77

(Table 1)



(Fig. 10)

(Fig. 11)



(Fig. 12)