

How Steel Web Elevator Belt & SJ Buckets Enhance the Performance of Bucket Elevators

Introduction

With the demand for larger capacities, for more efficient and cost effective elevators to carry industrial products such as cement, 4B has researched, tested and supplied the industry for over the last nine years with an integrated system of steel web belting, SJ buckets and elevator designs for compact industrial elevators.

4B have designed, developed and successfully introduced the 4B steel reinforced elevator belt system and high capacity Starco Jumbo elevator buckets to achieve very high capacity at a comparatively lower cost than using chain or traditional belting with fabricated buckets.

Traditional Systems

In the majority of cement and other heavy industrial applications, elevators have traditionally been installed with chain on a worldwide basis. Chain, however, can be very expensive and have immense maintenance implications after installation.

Chain bucket elevators traditionally use large casing dimensions, large cumbersome elevator buckets, which are pitched apart at quite a large distance. Chain operates at quite low speed (1.3 m/s), due to frictional and noise problems, which has a net result of limiting the case size. Also high strength, large construction chain, large motors etc are required on chain and bucket elevators. All these combinations contribute to an expensive elevator, in initial cost, further maintenance costs, and expensive downtime.

Large cumbersome fabricated elevator buckets can also be used with belting. These are also a very expensive option like the chain, because they also take up a lot of volume within an elevator casing, and fabricated buckets are very expensive compared to their pressed counterpart. As a result the casing will become larger and more expensive.

The SJ and Steel Web Belt alternative

As an alternative to this old fashioned tried and tested approach, 4B have developed a steel reinforced belting system, incorporating the unique SJ bucket design.

The Starco Jumbo and Steel web belting can use multi rows (one to four rows of three different sizes) of closely spaced, heavy-duty Jumbo seamless steel buckets and purpose designed steel web system, high temperature elevator belt.

Elevator belt will wear significantly less than the chain alternative. This is mainly due to lack of moving parts as compared with the chain links and sprockets. As the chain will undergo constant friction between each part, thus causing constant wear, then eventually downtime.

The elevator buckets are pressed from 4mm mild steel and will therefore have extensive lifetime of use. A wearband, welded onto the front edge and sides of the buckets is an option if the product is particularly abrasive. The buckets are designed to achieve very high capacities through their unique optimum design

characteristics, which maximizes bucket fill and will ease product release. The elevator buckets are also designed in such a way, that they can be spaced at very tight intervals, unlike the traditional system. The buckets can also be used up to 2.3 m/s on the larger pulley diameters (which is still gravity discharge), which will enable high capacity. This all has a positive effect on the reduction of the casing size.

Comparisons between traditional chain system and our steel web belt / SJ system

As previously described, using our SJ elevator bucket system and steel web belt, you can achieve far higher capacities for the given space provided. The following comparison demonstrates the differences between chain and bucket with the steel web belt and SJ buckets. This shows that you can use much smaller case sizes, due to the faster speeds and more efficient bucket size and spacing. In general terms you can save around a third of the case size compared with the SJ buckets.

Traditional chain elevator to jumbo and steel cord belt to handle 300M³/hour.

Chain and Bucket		Steelcord Belt and SJ Buckets	
Sprocket	900 PCD	Pulley Dia	900 dia
Chain speed	1.3M/S	Belt Speed	1.9 m/s
Bucket	DIN 15234 1250*400	Bucket	2 rows of SJ370-250
Case	1400*560	Case	930*400

= Reduced case and Lower machine cost

Super Jumbo bucket, Steel cord belt and case size

The following table illustrates the various different combinations of capacities that can be achieved using our system. The differing combinations are achieved using various size pulleys and multi rows of SJ buckets, as opposed to using large cumbersome fabricated buckets.

**Cement Elevator Capacities with SJ Buckets at 4.9/Metre
Material Portland Cement at 1.12 Density and with 90% fill or Water Level**

BKTS 250 MM PROJ	SJ470	SJ470	SJ470	SJ370	SJ370	SJ370	SJ370
ROWS	1	2	3	1	2	3	4
BELT WIDTH MM	520	1040	1560	410	820	1170	1600
CASE WIDTH MM	650	1150	1620	540	930	1320	1640
CASE DEPTH MM	400	400	400	400	400	400	400
CAPACITIES							
PULLEY DIA MM	900	900	900	900	900	900	900
BELT SPEED M/S	1.9	1.9	1.9	1.9	1.9	1.9	1.9
TPH	<u>350</u>	<u>700</u>	<u>1050</u>	<u>280</u>	<u>560</u>	<u>840</u>	<u>1120</u>
M3/HR	313	625	950	250	500	750	1000
PULLEY DIA MM	1000	1000	1000	1000	1000	1000	1000
BELT SPEED M/S	2.02	2.02	2.02	2.02	2.02	2.02	2.02
TPH	<u>375</u>	<u>754</u>	<u>1130</u>	<u>298</u>	<u>595</u>	<u>890</u>	<u>1190</u>
M3/HR	335	670	1010	260	530	800	1060
PULLEY DIA MM	1200	1200	1200	1200	1200	1200	1200
BELT SPEED M/S	2.25	2.25	2.25	2.25	2.25	2.25	2.25
TPH	<u>420</u>	<u>840</u>	<u>1260</u>	<u>330</u>	<u>664</u>	<u>995</u>	<u>1325</u>
M3/HR	375	750	1125	295	590	890	1185

High capacity – low maintenance System for Industrial Elevators

* Compared to traditional chain and bucket elevators 4B Steel Web Belt fitted with Starco Jumbo buckets offer you:

- Up to double the elevator capacity;
- Throughputs up to 1300 TPH and over;
- Much lower capital investment;
- Longer trouble free life;
- Reduced maintenance and spares cost;
- Opportunity to upgrade capacity of existing elevators.

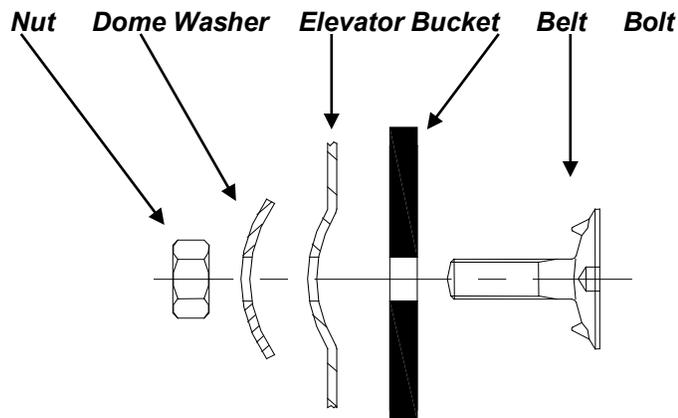
4B Steel Web Belt

The steel web belt has less frictional and wear points as compared to chain. The Belt also has very thick covers (usually 4 or 5 mm) to withstand the rigors of cement and other abrasive industrial products.

Due to the construction of the 4B Steel Web Belt, the belt will have near zero stretch. In the past the other fear with using elevator belts as opposed to chain, is that the belt will stretch under initial use, this will not happen with steel web belt, due to the special E-cords in the warp and weft.

4B can offer belt strength up to 2000KN/M, which will cope with the toughest of applications. The belt is also guaranteed and can last for many years depending on application. All belts come with punched holes on application.

A special Allan key head bolt can be used to enable ease of use and access into the holes of the belt by using an electric drill with an Allan key bit to screw the bolt through the belt (see sketch).



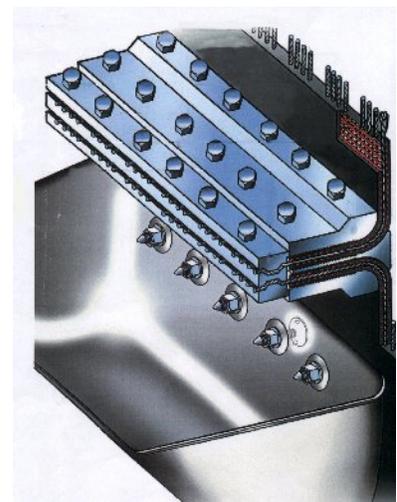
Allan key head bolt complete with view of belt, bucket, domed washer and nut.

The elevator belt has a constant operation temperature of 120°C with peaks of 150°C, which will allow for most cement and other industrial applications. Thick covers, usually 4 mm are used on the belt, to cope with high abrasion and temperature levels that can be experienced with many industrial applications.

- * Specially constructed to suit the SJ buckets and fasteners
 - * Weft as well as warp cables to add strength stability and bolt holding
 - * Strengths from 800 to 2000 kN/m
 - * Operating temperature up to 120 °C – peaks of 150'c
- * Negligible Belt Stretch

Belt fasteners and bucket arrangement

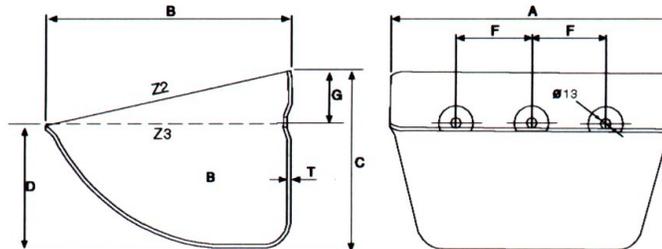
- * Specially designed Clamp for Starco jumbo buckets and 4B steel web belt combination.
- * Standard clamp for up to 1200 KN/M belt – made in aluminum
- * Clamp for 2000KN/M belt – made in steel and aluminum



The Starco Jumbo Elevator Bucket

TYPE SJ General Specifications

Starco Jumbo
Pressed Steel



Specification

Bucket No	A mm	B mm	C mm	D mm	T mm	kg	Capacity (L)		Recessed Holes Slotted				
							Z2	Z3	No	E	F	G	B / M
SJ 330-250	340	260	190	130	3.0/	4.5	9.6	7.2	3	13	80	55	5
					4.0	6.0							
SJ 370-250	380	260	190	130	3.0/	5.1	10.8	8.3	4	13	80	55	5
					4.0	6.72							
SJ 470-250	480	260	190	130	3.0/	6.5	14.0	10.5	5	13	80	55	5
					4.0	8.6							

The buckets also have the ability to have a very small space in between each bucket; therefore very high capacities can be achieved.

SJ buckets are pressed from 3 or 4 mm mild steel, and can be fitted with wear bands if the product is particularly abrasive.

Case Studies

We have successfully completed numerous elevator designs for new bucket elevators. 4B can offer free engineering design specifying the correct elevator buckets, belting, bolts, case sizes, motors etc, in order that the bucket elevator manufacturers can manufacture the optimum and most cost-effective elevator. This service can also be offered to the end users, such as cement plants, whereby their existing bucket elevators can be changed over from chain and the capacity increased, and even doubled. Here are two examples of bucket elevators one showing a new elevator we designed and one we retrofitted from chain, using our SJ elevator bucket and steel cord belt.

The first example is for a bucket elevator where the elevator did not reach the anticipated capacity of 180-200 TPH and frequently lost buckets due to bucket fixing bolts being pulled through the belt. The belts often misaligned, also the casing side was damaged by off-tracking belts.

4B steel web belt with higher safety factor and cross rigid construction was fitted for improved tracking. The belt speed and belt strength was increased. The large fabricated buckets were replaced by the SJ370 buckets at a reduced pitch to achieve the desired capacity of minimum 200 TPH (actually calculated – 285 TPH). Retrofit using – T130'c belt 4+4 covers, SJ370-250 (4 mm thick) pressed steel buckets and M12x50 Allan key DIN bolts with high temperature resistant locknuts, and a special aluminium clamp.



The next example is of an existing chain elevator in Australia that was upgraded from 120 TPH of cement, up to 250 TPH by retrofitting and installing one row of SJ470 buckets and using 4B steel web belt SW1000 4+4. The original elevator 25 meters high, had chain installed, and it was decided to change over to 4B steel web belt with SJ buckets to improve the performance and life.



The head lagging is shown during installation of the belt.

To complement their elevator components supply, 4B have a free detailed engineering design service. The service will give engineering drawings, optimum speeds and elevator sizes etc, to take away the worry of capacity and size calculations from the machine manufacturer. This facility is also available to the end user, with respect to the upgrading of existing elevators.

In conclusion the SJ buckets and 4B steel web belt can offer the following features and advantages:

SJ system for cement

- * Replaces traditional chain and bucket elevators
- * Replaces very large cumbersome belt and very large slow bucket elevators

Traditional chain and bucket elevators are limited because:

- * Uses heavy chain and large fabricated buckets
- * Limited number of buckets per meter
- * Max speed 1.3 M/S restricts capacity
- * Chain and sprockets wear quickly
- * High maintenance and replacement costs
- * High capacity requires very large elevator construction

Starco Jumbo and 4B steel web belting elevator are advantageous because:

- * Uses 1 to 4 rows of closely spaced heavy-duty starco jumbo seamless steel buckets
- * In conjunction with purpose designed steel cord high temperature elevator belt
- * Capable of up to 2.3 M/S belt speed
- * Achieves far greater capacities per case size than chain – up to double
- * Saves 33% of components costs
- * Much lower capital investment
- * Belt wears less than chain
- * Reduced maintenance and spares cost
- * Reduces down time and maintenance costs
- * Throughputs up to 1300 TPH and over
- * 4B steel web belt does not stretch

Reference Lists on request.

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