

# Technical News Bulletin

April, 2019

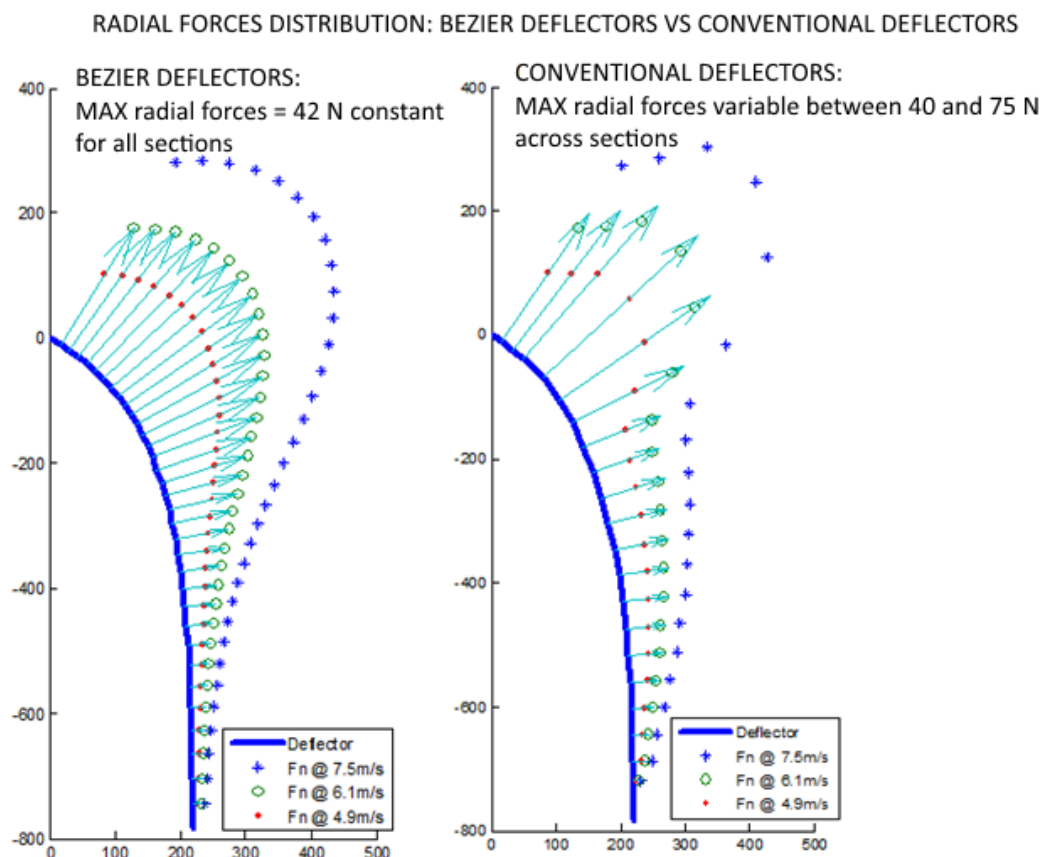
## Enhanced Gob Loading Constant Cone Bezier Delivery

### Introduction

The Constant Cone Bezier Delivery is the latest development of the Constant Cone delivery launched by Bucher Emhart Glass in 2015 (TNB 235).

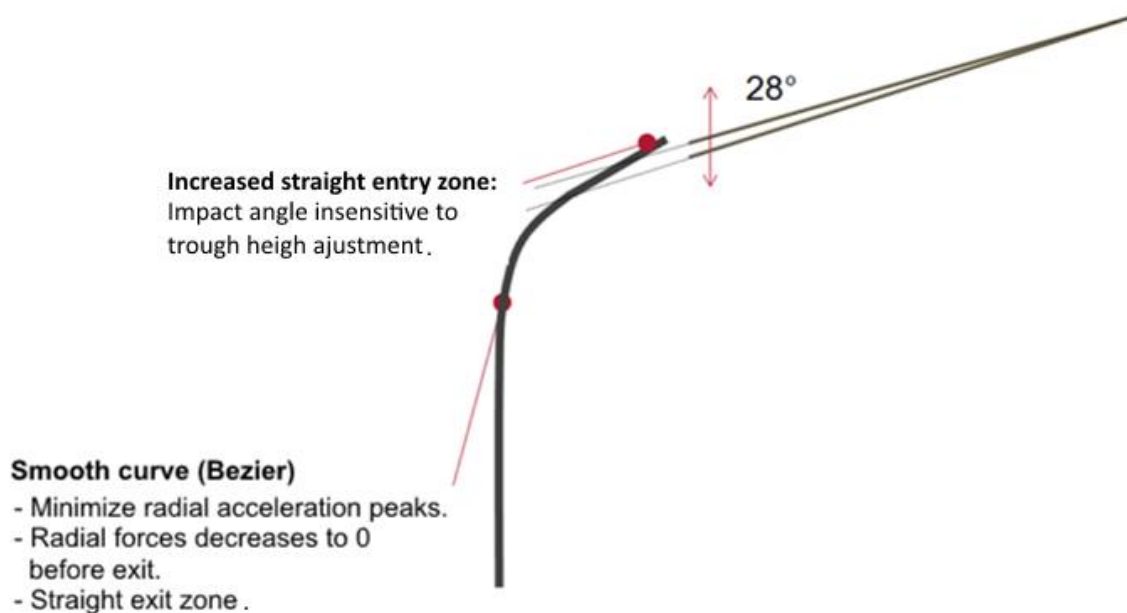
The Constant Cone Bezier Delivery system introduces a new family of Deflectors whose profile is inspired by the Bezier curves, a parametric function based on the Bernstein polynomial used since the 1960s to model smooth curves.

The application of a Bezier curve in the definition of the deflector profile results in a reduction and a homogeneity of the centripetal acceleration of the gobs during their transition through the deflector.



Picture 1: Plot of radial forces acting on deflectors, maximum radial force using Bezier curve is 42 N for all the sections, with 18000 series deflectors the maximum radial forces varies between sections from 40N to 75N.

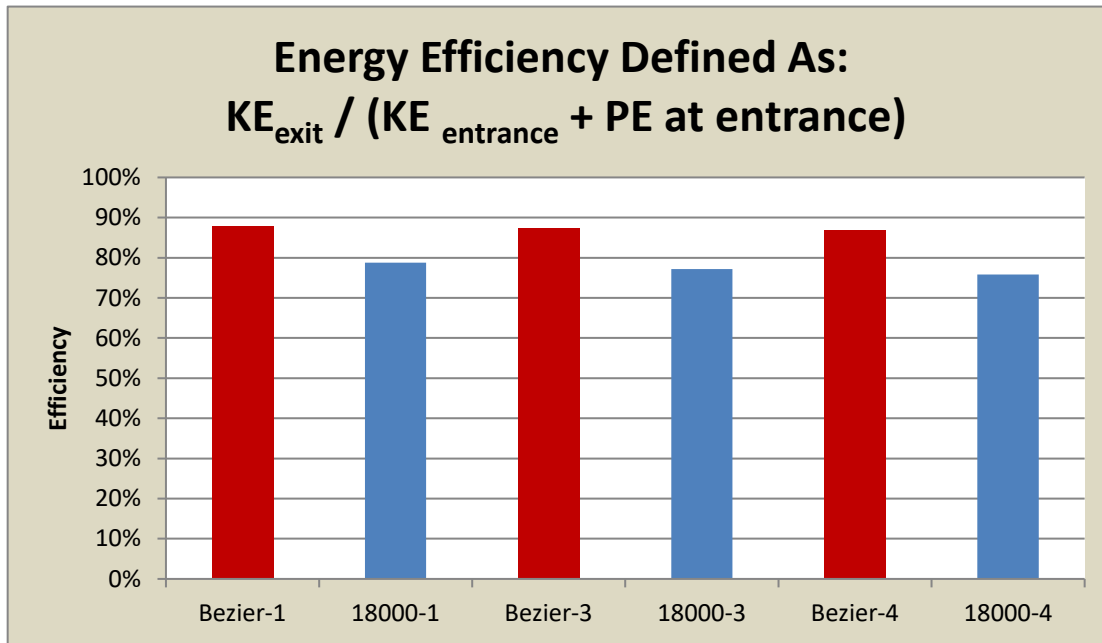
A straight extension has been added to the deflector's profile to maximize the advantages of the new curve, considering that in a Constant Cone Delivery all the troughs are having the same angle. The troughs for Constant Cone Bezier Delivery were shortened to compensate the additional straight extension at the deflector's entry.



Picture 2: Concept - Bezier curve with straight entrance

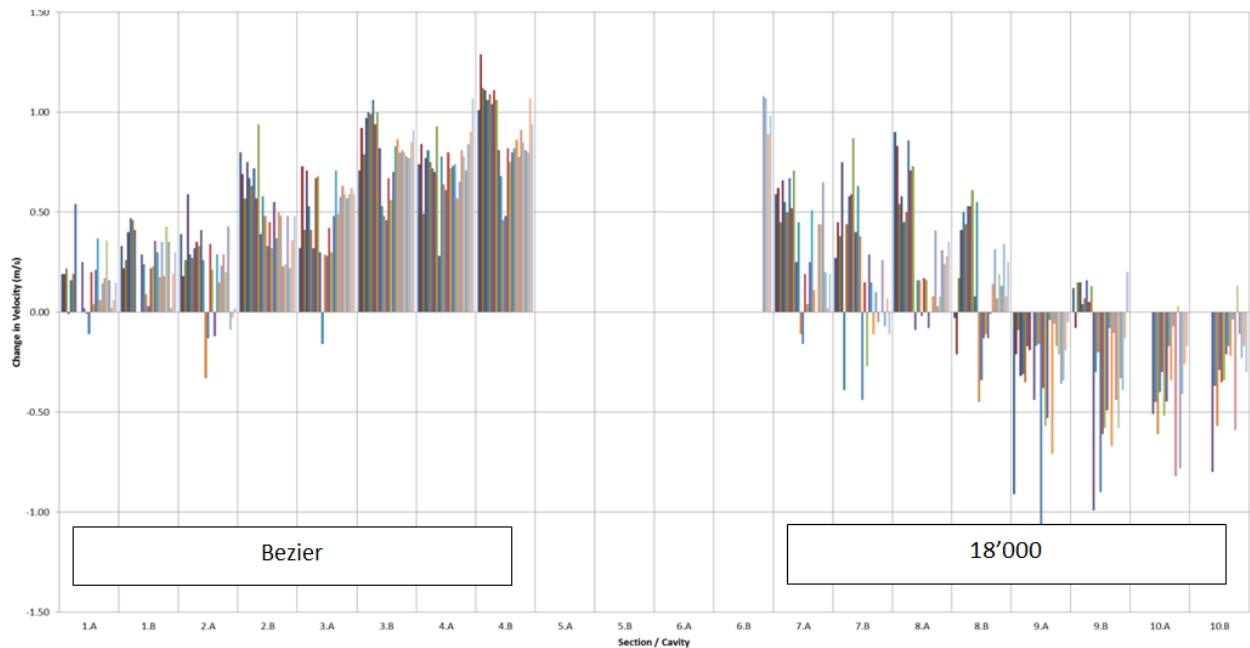
The advantages of the Constant Cone Bezier Delivery are:

- reduced gob entry angle variations
- reduced impact forces
- reduced and homogeneous normal forces along the sections and between cavities (see picture 1)
- less kinematical energy dissipation (See Picture 3)
- reduced gob shape variations
- increased loading stability (See Picture 4)
- higher loading speed (See Picture 4)
- longer coating lifetime (See Picture 5)



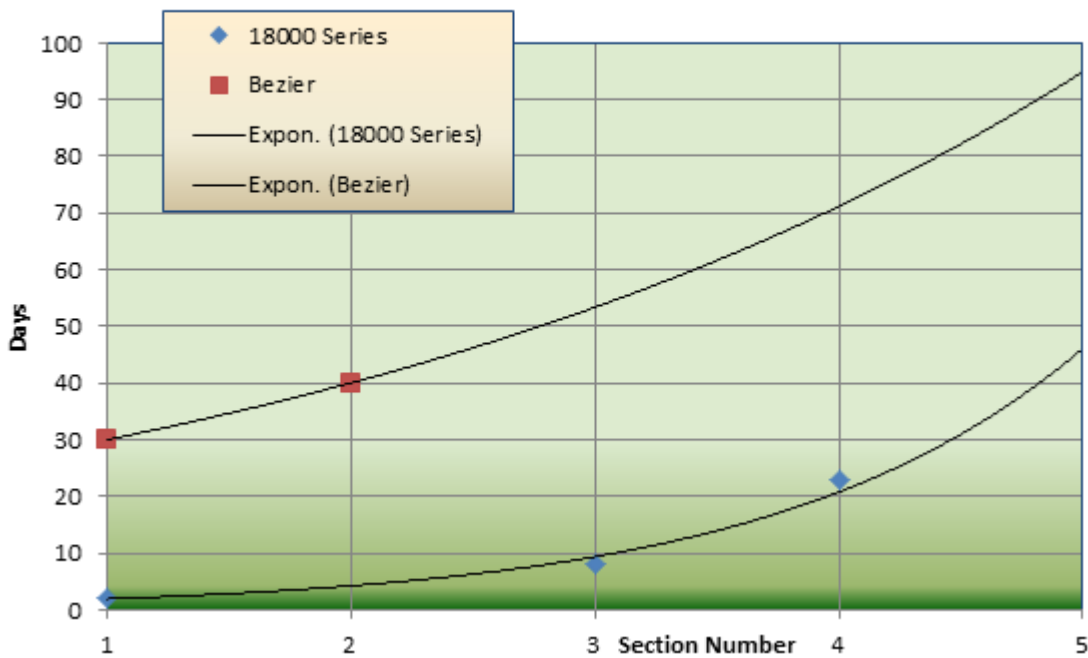
Picture 3: comparison of Energy efficiency between Bezier and conventional deflectors. The Bezier curve and the longer landing zone creates less Kinetic energy dissipation during the transition in the deflectors.

Legend: KE = Kinetic Energy, PE = Potential Energy

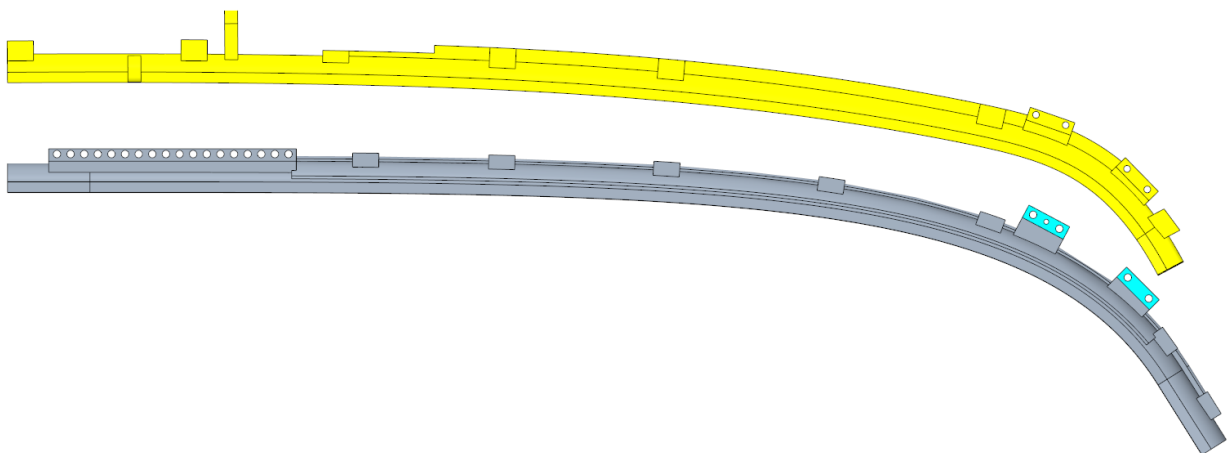


Picture 4: Changes in velocity Bezier Vs previous delivery from field trials on a 10 sections machine. Negative values means that gobs are decelerating during their transition through the delivery equipment.

### Coating Life

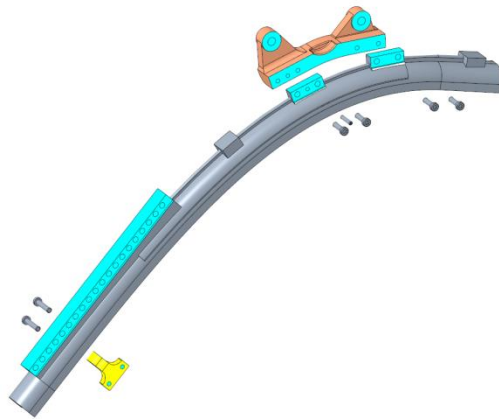


Picture 5: the graph shows the differences in terms of deflector coating duration between Bezier and conventional delivery. The reduction of the impact forces and the optimization of the radial forces have a huge impact on the coating life time.



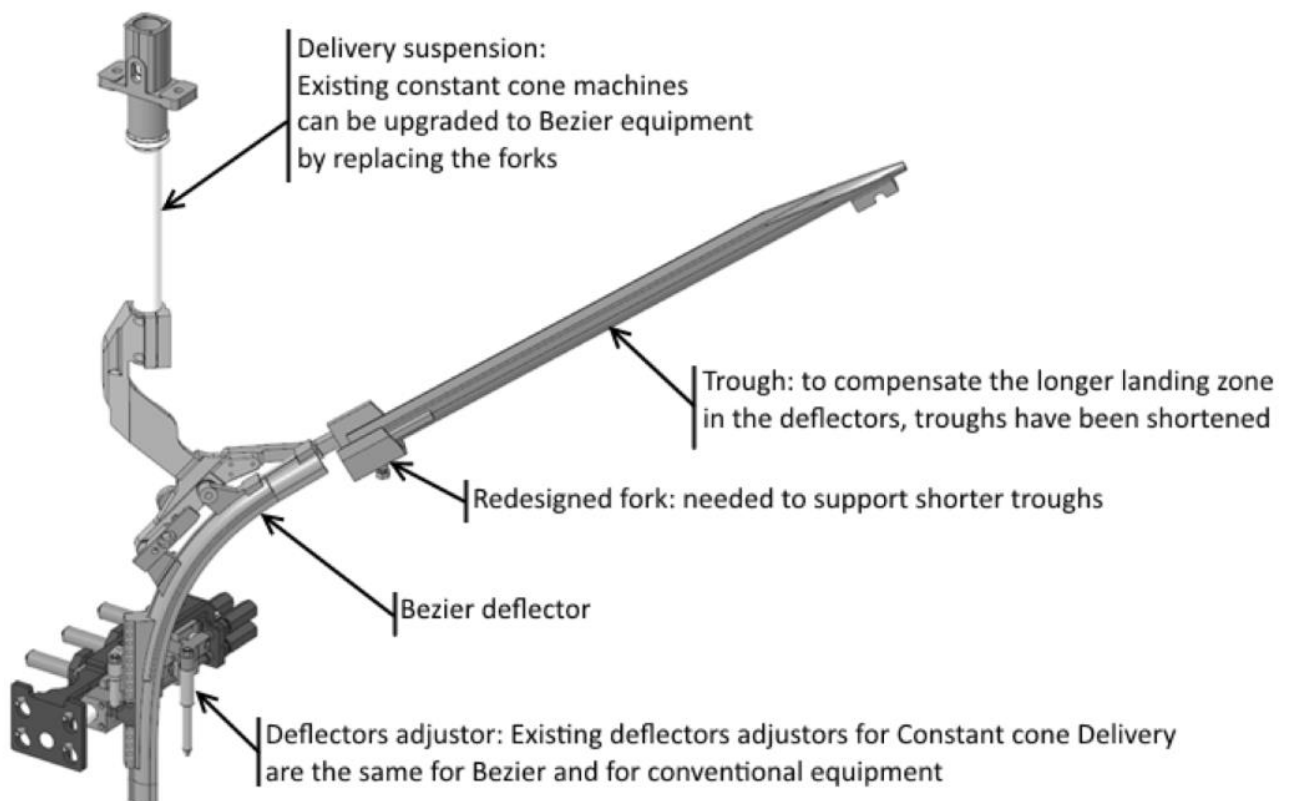
Picture 6: comparison of Bezier deflector (grey) and conventional deflector highlighting the larger curvature and the straight landing zone which are the key points in the Bezier design

The Bezier deflectors also present a redesigned lower lug, which is assembled on a rack. The rack is casted and machined as part of the deflector body and the lugs are separate parts which are assembled for specific cavities and sections. This configuration results in a higher flexibility for assembly and for spare parts orders.



## Specification

The Constant Cone Bezier Delivery is available for IS, AIS, NIS and BIS machines. Existing machines with Constant cone delivery can be upgraded to Bezier equipment by replacing deflectors, troughs and forks.



# BUCHER

## emhart glass

### Constant Cone Bezier Delivery master lists

		IS/AIS 6 sect	IS/AIS 8 sect	IS/AIS 10 sect	IS/AIS 12 sect	NIS 8 sect	NIS 10 sect	NIS 12 sect	BIS 8 sect	BIS 10 sect	BIS 12 sect
Delivery system		210-2150-00	210-2152-00	210-2154-00	210-2156-00	400-5403-00	400-5404-00	400-5405-00	401-1507-2	401-1509-2	401-1511-2
Suspension	SG	401-1364-12	401-1183-16	401-1227-12	401-1107-11	N/A	N/A	N/A	N/A	N/A	N/A
Suspension	DG	401-1364-9	401-1183-13	401-1227-9	401-1007-9	400-5222-2	400-5192-2	400-5147-2	401-1183-13	401-1227-9	401-1007-9
Suspension	TG	401-1364-10	401-1183-14	401-1227-10	401-1007-10	400-5223-2	400-5193-2	400-5148-2	401-1183-14	401-1227-10	401-1007-10
Suspension	QG	N/A	N/A	N/A	N/A	400-5224-2	400-5194-2	400-5149-2	N/A	N/A	N/A
Deflector Adjustor		210-2051-00				400-5087-00			401-1050-00		
Trough bracket		401-1182-00			401-1101-00	400-5138-00			401-1182-00	401-1101-00	
Delivery equipment		401-1537-00	401-1515-00	401-1525-00	401-1532-00	400-5408-00	400-5410-00	400-5412-00	401-1515-00	401-1525-00	401-1532-00
Set of Troughs	SG					N/A	N/A	N/A	N/A	N/A	N/A
Set of Troughs	DG	401-1539-00	401-1517-00	401-1527-00	401-1534-00	400-5429-00	400-5417-00	400-5423-00	401-1517-00	401-1527-00	401-1534-00
Set of Troughs	TG					400-5430-00	400-5418-00	400-5424-00			
Set of Troughs	QG	N/A	N/A	N/A	N/A	400-5431-00	400-5419-00	400-5425-00	N/A	N/A	N/A
Set of deflectors	SG					N/A	N/A	N/A	N/A	N/A	N/A
Set of deflectors	DG	401-1538-00	401-1516-00	401-1526-00	401-1533-00	400-5426-00	400-5414-00	400-5420-00	401-1516-00	401-1526-00	N/A
Set of deflectors	TG					400-5427-00	400-5415-00	400-5421-00			401-1533-00
Set of deflectors	QG	N/A	N/A	N/A	N/A	400-5428-00	400-5416-00	400-5422-00	N/A	N/A	N/A

Application notes:

(\*) Delivery suspension for IS/AIS in Single gob uses double gob parts. Delivery equipment selection is limited to double gob sizes. (Deflectors from 3/8" to 1-3/4")

(\*\*) Single gob application on IS and AIS 6,8 and 10 sections is as subset of double gob for deflector sizes up to 1-3/4" and using troughs 0-2, 2-3 and #3-1/2

(\*\*\*) Single gob application with deflectors sizes from 1-3/4" to 2-3/4" needs a specific single gob suspension and is not planned to be Bezier type.

(\*\*\*\*) Standard troughs are in black steel fabricated. Trough sizes 0-2 and 2-3 for DG and TG machines are available in machined cast iron. Troughs double gob size #3-1/2 re available in machine cast iron only.

## Installation Requirements

The Constant Cone Bezier Delivery can be specified as standard for all new machines.

Upgrade of existing machines already equipped with constant cone delivery is possible by replacing troughs and deflectors and by upgrading the suspension.

The suspension upgrade for Bezier equipment consists in the forks replacement.

		12 SECTIONS			10 SECTIONS			8 SECTIONS			6 SECTIONS		
		DG	TG	SG	DG	TG	SG	DG	TG	SG	DG	TG	SG
FORK RH	401-13097	12	18	6	10	15	/	8	12	/	6	9	/
FORK LH	401-13098	12	18	6	10	15	/	8	12	/	6	9	/

## Features / Benefits

Features	Benefits
Smoother curve	Reduced radial forces → Reduced gob shape variation + increased loading stability + higher loading speed + longer coating life
Straight deflector entrance	Insensitive to trough height adjusting, reduced impact forces → longer coating life + reduced gob shape variation + increased loading stability + higher loading speed
Built in rack	Easier setup, increased flexibility, spare parts optimization