



Servo Technology Experience 2016 (Nashville)




Agenda



- Why transfers?
- Transfer Technology History
- Transfer Configurations
- How Transfer's Integrate with Presses
- Transfer Tooling Options
- Auxiliary Tooling & Die Options
- New Technologies
- Press Considerations for Transfer
- Questions

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Why Transfers?

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Why Transfer



Part Complexity




- Some operations like flanging and some cam operations can be preformed easier in a transfer die.
- In transfer tooling attitude changes, part rotation etc. can be easily achieved thus allowing die designers freedom not available in progressive dies.
- Due to material, certain forming must be completed in single stages
- Deep Draw

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Why Transfer


Manpower Cost:




Engineering Changes:



Die / Tool Maintenance Costs



Capital Investment

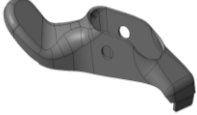


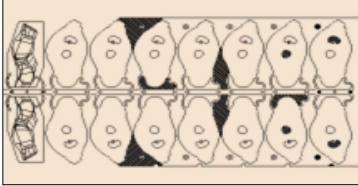
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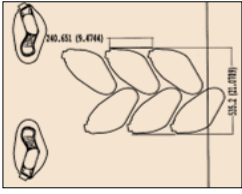
Why Transfer

Material Savings – In-Die Process Case Study





vs.



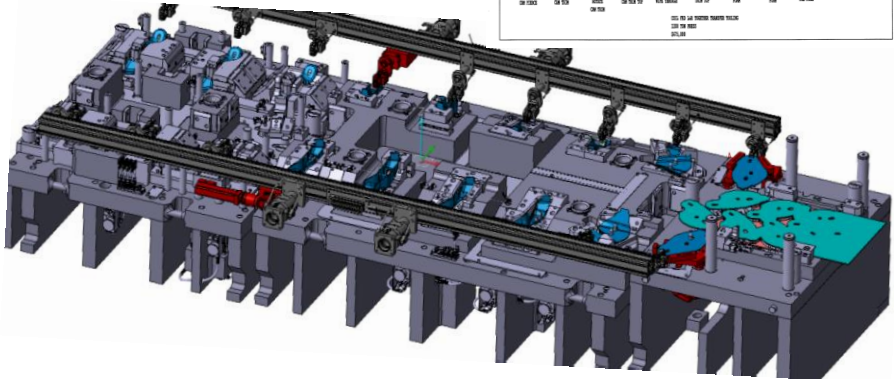
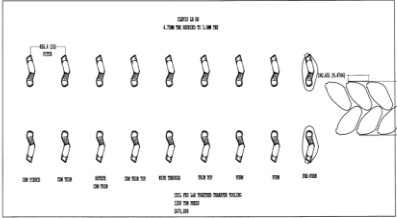
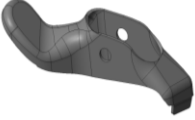
Material Utilization	Prog	Transfer
Blank size =	31" x 8"	19.44" x 9.4"
Mat'l per car set =	9.96#	7.34#
Mat'l \$ per car set =	\$5.3461	\$3.9400

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Why Transfer

Material Savings – In-Die Process Case Study



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Transfer Technology History

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Transfer Technology

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Timeline

- Progressive and Hand Transfer (till 1980's)
- Mechanical Transfer Systems (1980s – 2000s)
 - In-die Mechanical transfer – exist today for specific Products
- Servo-Mechanical Systems (2000s –today)
- 100% Servo Systems (1990 – today)

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Mechanical Systems



Jacar Systems

- Motion caused by Cams driven by Press Ram and / of drive shafts from PTO on press.
- Limitations
 - Fixed motion profiles with respect to press ram position
 - Fixed stroke lengths
 - Limitation on max. stroke lengths
 - Any changes to above required change of cam plates etc.. i.e.. Mechanical changes

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Servo-Mechanical Systems

- Clamp & Lift motions caused by Cams driven by Press Ram and / of drive shafts from PTO on press.
- Pitch Motion by Servo-motor
- Limitations for clamp & lift axes
 - Fixed motion profiles with respect to press ram position
 - Fixed stroke lengths
 - Limitation on max. stroke lengths
 - Any changes to above required change of cam plates etc.. I.e.. Mechanical changes

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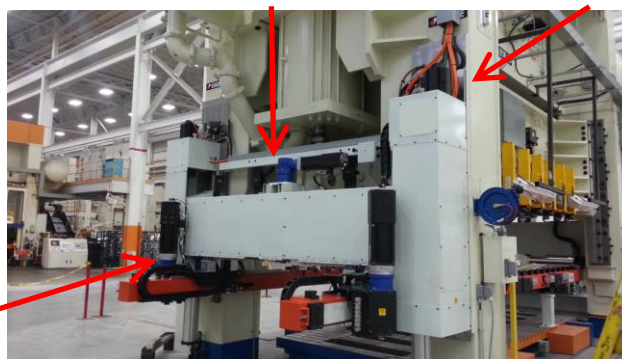
100% Servo Systems

- All Axes motion controlled by Servo-Motors
- All axes freely programmable for stroke length and also motion profile with respect to press ram position
- Allowed for optimal motion for each die thus higher production speeds
- Changes via HMI Touch-screen

Clamp Axis Servomotors

Lift Axis Servomotors

Pitch Axis
Servomotors



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Transfer Configurations?

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Transfer Configurations

“WM” Series



“Through the Window” Style:



Advantages:

- *Can install sound doors*
- *High Visibility of Dies during operation*

Disadvantages

- *Occupies space on Ends of press*
- *Coil & Blank Feeders further away*
- *Press Window must accommodate Transfer Rails*
- *As Bolster size increases – so does Transfer Rail Cross-Section*
- *When running Progressive Dies – must account for Tooling Rails in window and over bolster*

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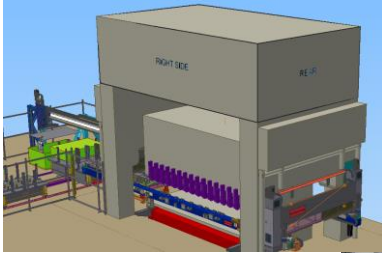
Transfer Configurations

“WM” Series



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Above Pass-Line



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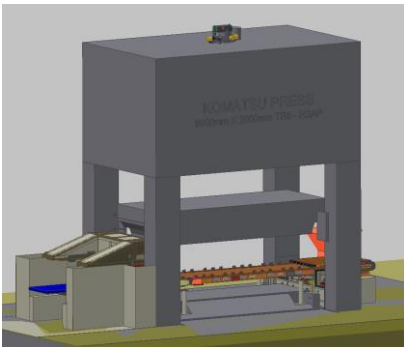
Transfer Configurations

“WM” Series



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Above Pass-Line & Below (Combination)



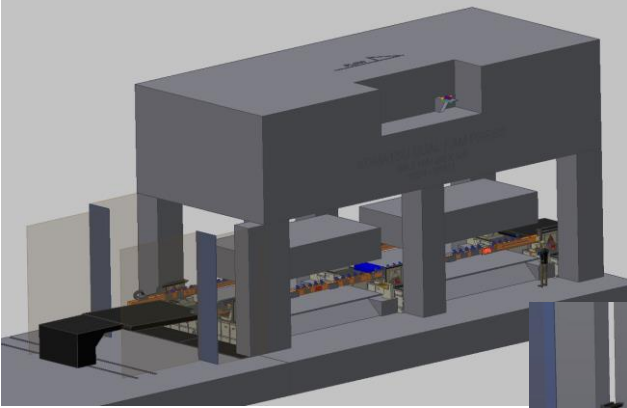
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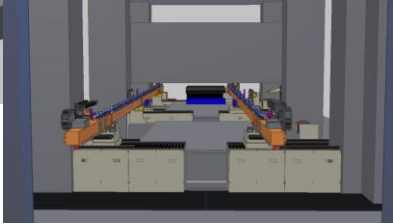
Transfer Configurations

"WM" Series

Below / In-Between Columns



Typically used in Multi-Ram systems (Dual)



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Transfer Configurations

"WM" Series

Below / In-Between Columns



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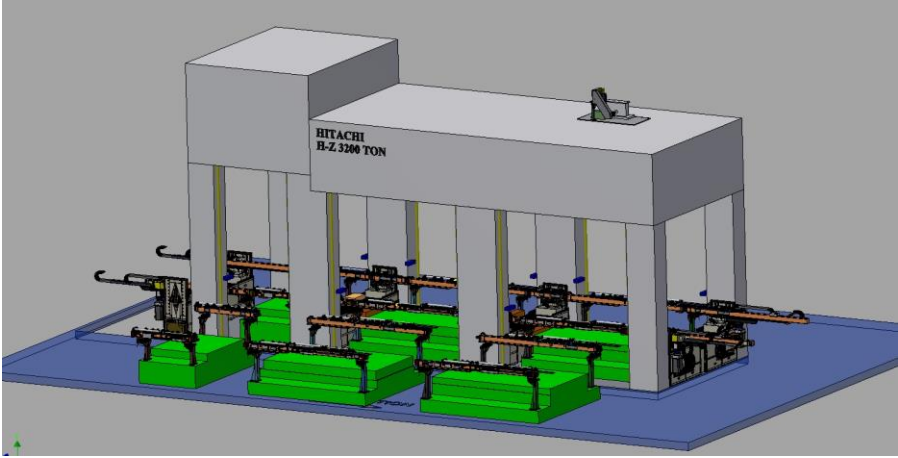
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Transfer Configurations

“WM” Series

Below / In-Between Columns





Typically used in Multi-Ram systems (Triple Ram)


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Transfer Configurations

“WM” Series

Below / In-Between Columns






Typically used in Multi-Ram systems (Triple Ram)

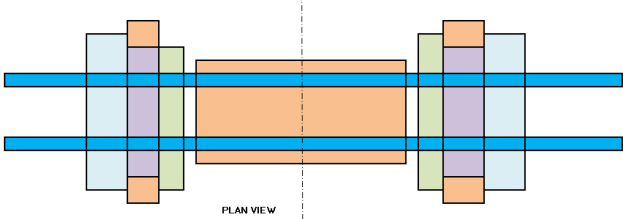
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Transfer Configurations

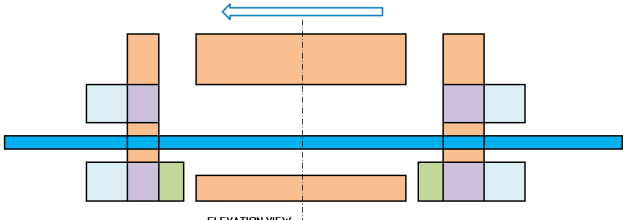
“WM” Series





PLAN VIEW

Transfer Mounting options / Locations




ELEVATION VIEW

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Transfer Configurations

“FR” Series



“Front & Rear” Style:



Advantages:

- Can be mounted on Press's with small or no windows
- Can be retrofitted on any press
- 100% independent motion (Front – Back)
- Larger Range of motion
- Can retract up out of the way when not using transfer dies
- Can be upgraded to run in Multi-Directional
- Can be adapted easily for emergency takeover work

Disadvantages:

- Cannot mount Sound doors
- Can be higher priced than WM series on smaller bolsters


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Transfer Configurations


“FR” Series

When Running Transfer





When at Store Position



Auxiliary Lift Axis – to move transfer out of way when not in use or for Die Change

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Transfer Configurations


“FR” Series



FR-4P Models

- Larger Bolster sizes
- Dual Transfer units / Side

FR-MD

- Multi-Directional Transfer functionality
- Production (L-R) and (F-B)







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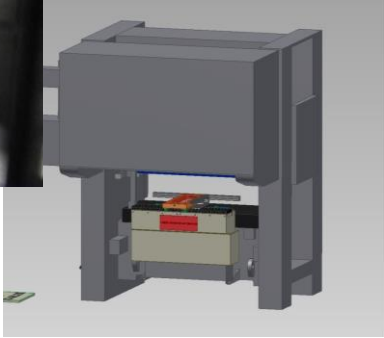
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Transfer Configurations

“BM” Series



“Bolster Mounted” Style:





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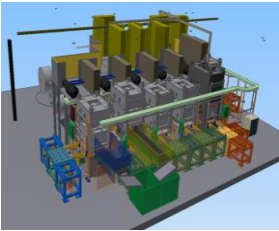
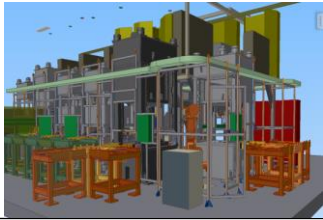

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Transfer Configurations

“P2P” Series



“Press to Press” Style:

		<ul style="list-style-type: none"> • For small press Lines (Hydraulic or Mechanical press line)
		

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Transfer Configurations

“P2P” Series

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“Press to Press” Style:



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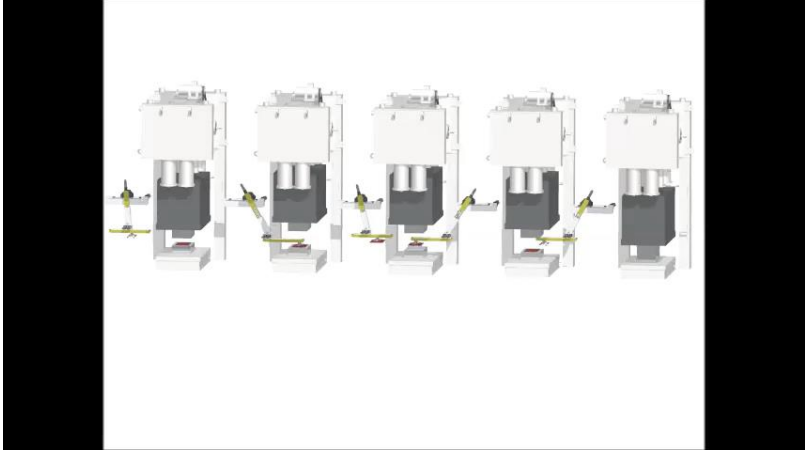
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Transfer Configurations

“TL” Series


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Tandem Line:



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How Transfer's Integrate with Presses

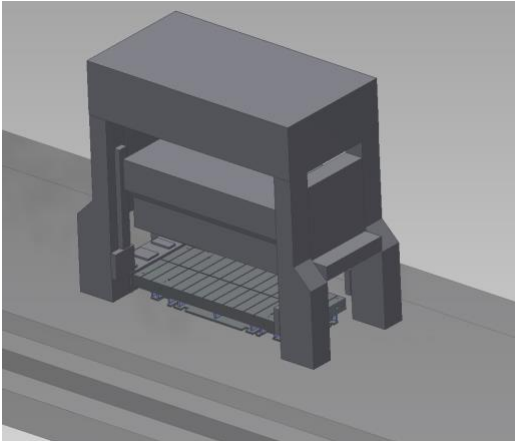
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Transfer Integration



- Transfer Mounting Pads on Press
- Electrical Interface on Press
- Transfer Encoder Mounting



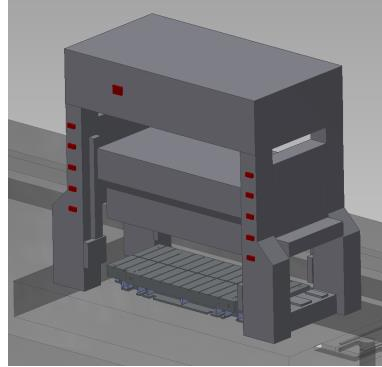
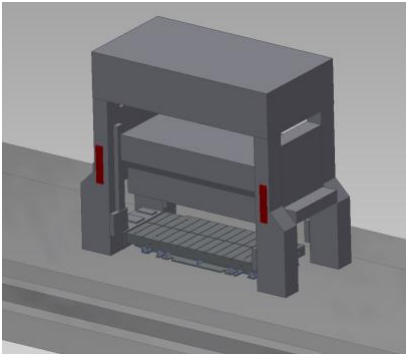
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Transfer Integration

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- Transfer Mounting Pads on Press



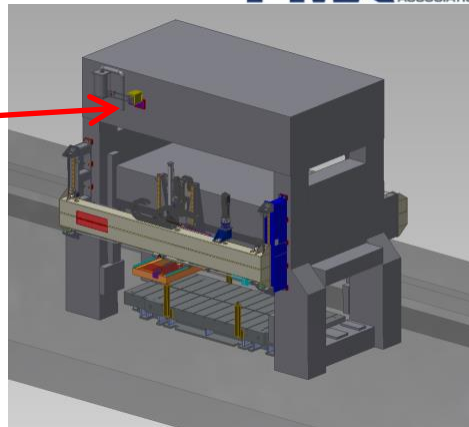
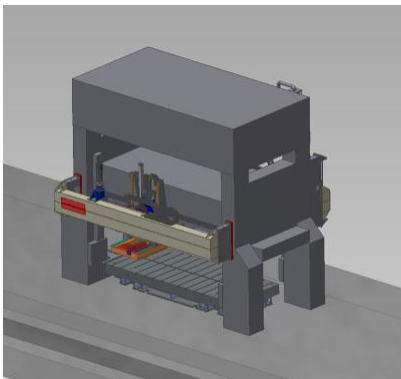
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Transfer Integration

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- Transfer Installation on Pads
- Transfer Encoder Mounting

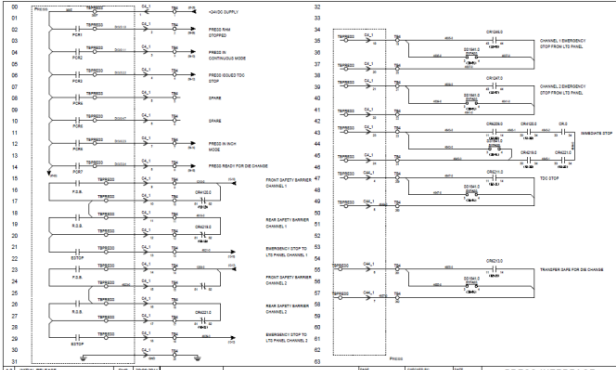


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Transfer Integration




- Electrical Interface
- Via Communication Network or Hardwire

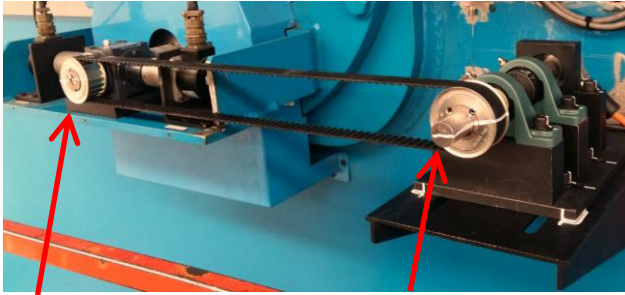


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Transfer Integration

Mechanical Press Synchronization





Press Output Shaft

Transfer Encoder Assembly


- Applicable for Eccentric, Crank or Link Motion Presses
- Press Output Shaft is Constant Velocity

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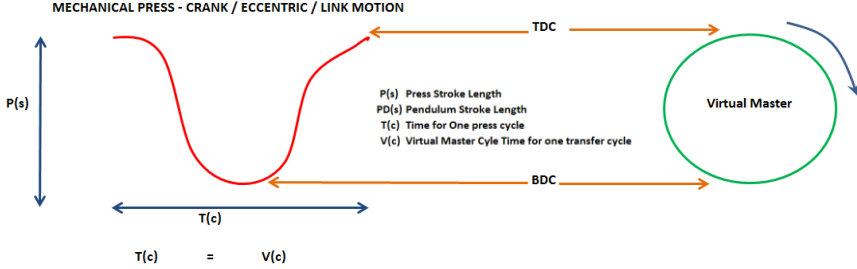
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Transfer Integration

Mechanical Press Synchronization



MECHANICAL PRESS - CRANK / ECCENTRIC / LINK MOTION



$T(c) = V(c)$


- Encoder pulses generate a virtual master signal which links transfer axes motions through a cam-table
- Cam table relates 0-360 degree crank angle to absolute position of each axis

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Transfer Integration

Servo Press Synchronization




- Virtual Master Signals now are provided by the Press Control rather than the transfer master encoder
- Virtual master signals are conditioned to provide a constant velocity output based on 0-360 degree cycle in the same time period as Press cycle – no matter press motion profile
- Thus Servo Press synchronization is a time based method

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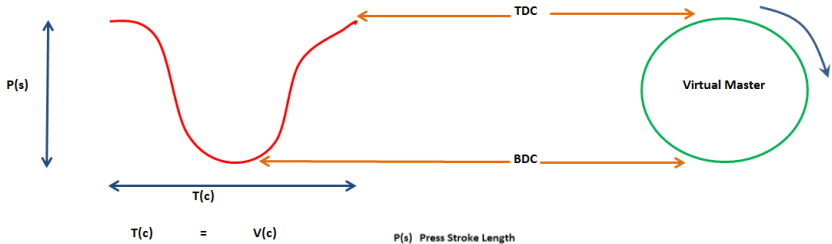
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Transfer Integration



Servo Press Synchronization

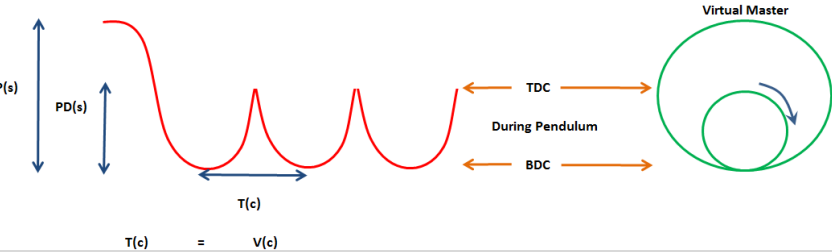
SERVO PRESS - CRANK / ECCENTRIC / LINK MOTION



$T(c) = V(c)$

P(s) Press Stroke Length
 PD(s) Pendulum Stroke Length
 T(c) Time for One press cycle
 V(c) Virtual Master Cycle Time for one transfer cycle

SERVO PRESS - PENDULUM MOTION




$T(c) = V(c)$


P(s) Press Stroke Length
 PD(s) Pendulum Stroke Length
 T(c) Time for One press cycle
 V(c) Virtual Master Cycle Time for one transfer cycle

During Pendulum

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Transfer Tooling Options

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Transfer Tooling Options

Receiver Style Tooling



Typically:

- Has control over die design and pitch control
- Has rolling bolsters





- Has a large number of transfer dies
- North American preferred method

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Transfer Tooling Options

Tooling Plates / Tooling Sub-Rails

Typically used at

- Where more flexibility is required set Pitch of receivers
- Has a large number of transfer dies
- Asian and European favored

Tooling Sub-Rails

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Transfer Tooling Options

Dedicated Rails / Die Set

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Typically used at

- Tier 2, Tier 3 level
- Has no rolling bolsters
- Has little control of product mix and does lot of take-over work
- Has a limited number of transfer dies

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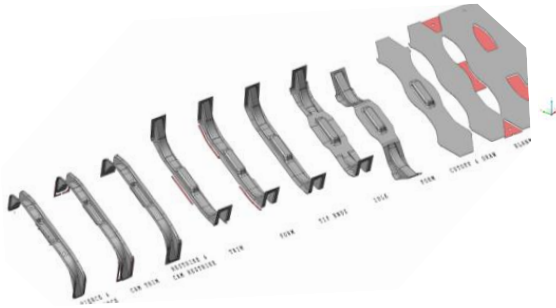
Auxiliary Tooling & Die Options

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Advanced Tooling & Die Options



- Pneumatic or Servo Part Rotation
- Pneumatic or Servo Pitch variation
- In-Die Servo Systems – part rotation, Ejection, Attitude adjustment
- In Die Assembly



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Advanced Tooling & Die Options



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New Technologies

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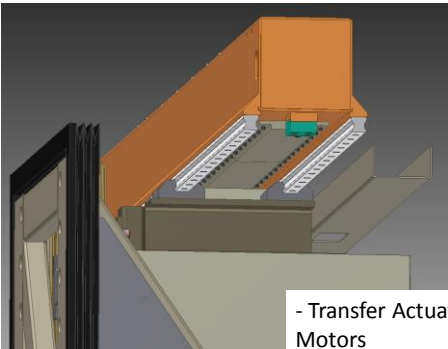
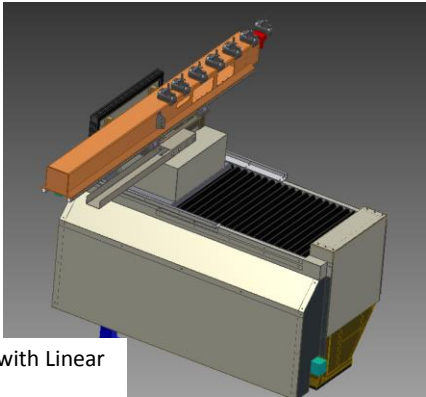
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New Technologies



Linear Motors

- Servo Press Technology requires higher performance transfer automation to maximize through put on pendulum and other motion profiles
- Linear Motor Technology can provide a direct drive, high dynamic response, high acceleration rate (up to 6-8 gs) and with proper guide ways can reach speeds excess of 5-7 m/s.

- Transfer Actuator with Linear Motors

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New Technologies

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- Medical Devices / Solar Panel production Transfer System
- Speeds up to 110 SPM
- Servo Driven Gripper System



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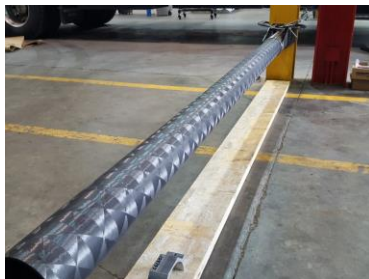
New Technologies

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Light Weight Material

- To meet higher dynamic performance characteristics, Steel and Aluminum are no longer the only materials being utilized for Transfer Rails / Transfer units or end-effectors
- Carbon Fiber, Composite materials and non-traditional construction methods are also being utilized such as Adhesion.





- Off the shelf – carbon fiber versus custom designed fiber rails and booms



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Press Considerations for Transfer

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Press Considerations

Press – General Information

- Press Stroke
- Press SPM
- Bolster Size
- Press Tonnage
- Press Window Size (defines “FR” or “WM”)
- Material Feed method
- Finished Part Handling
- Die Change methodology (Rolling Bolsters?)
- Transfer Tooling
 - Dedicated Bars
 - Receiver Style Tooling
 - Tooling Plates

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Press Considerations

Press – General Information

ELEVATION VIEW

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- A Column outside to Outside (L-R)
- B Dist. between columns (L-R)
- C Dist. Between press column and bolster (L-R)
- D Bolster Size (L-R)
- E Bolster Size (F-B)
- F Window opening (F-B)
- G Column outside to Outside (F-B)
- H Dist. Between press column and bolster (F-B)

ELEVATION VIEW

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- A Stroke of press
- B SDAU
- C Height of window
- D Height of Bolster (from Floor)
- E Height of feeder (from floor)
- F Dist. Feeder & Press Columns

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Press Considerations

Die Change Information

PLAN VIEW

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PLAN VIEW

PLAN VIEW

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QUESTIONS

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