

# “Gear Pump Systems for Extrusion”

by  
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## Gear Pump Systems - Strengths

- Controls surging
- Reduces backpressure & increases output
- Volumetrically accurate metering

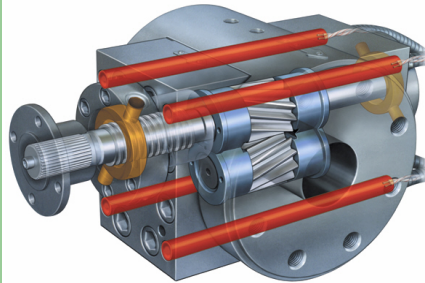


## Gear Pump Systems - Weaknesses

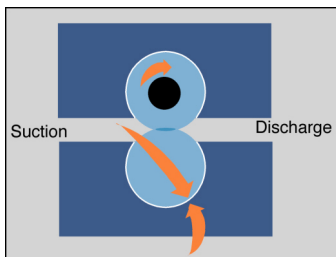
- High cost system
- Relatively maintenance intensive
- Difficult to install
- Machine direction only, no traverse gauge control



## What is a Gear Pump?

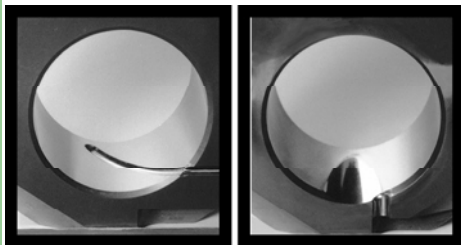


## Tight Rotational Clearances

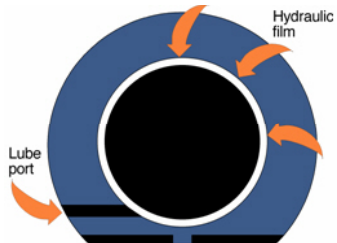


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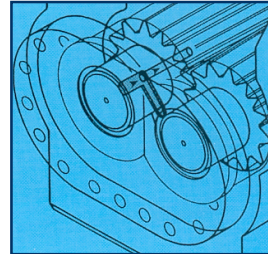
## Bearings



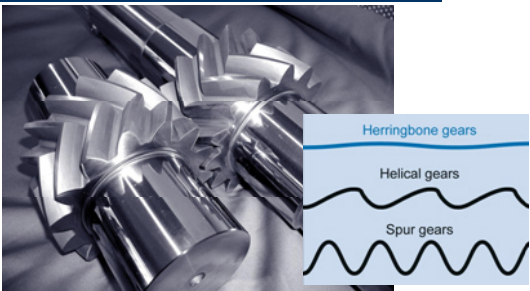
## Bearing Lubrication



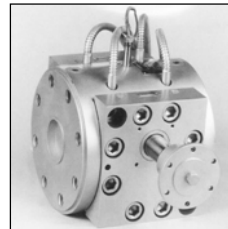
## Lubrication Return Grooves



## Gear Designs - Pulsation



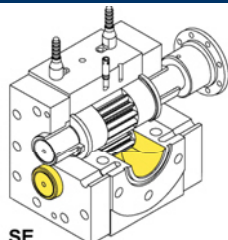
## History



- Gear pumps used in the extrusion process over 85 years
- First processes were fiber spinning
- Modern extrusion gear pump systems date from the 1970s

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## Specialty Gear Pumps



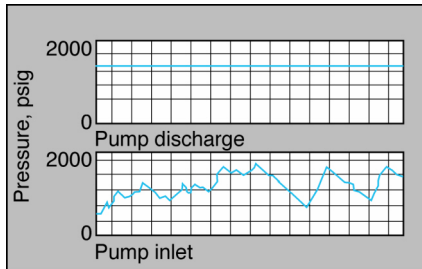
**SE**  
optimized inlet and outlet  
drainage of degraded polymer

## Benefits of the Pump in the Extrusion Process

- Elimination of surging and surge related defects in extrudate quality, resulting in higher yield per pound
- Faster start-ups and repeatable linear output flow
- Ability to run higher concentrations of regrind and off-spec materials
- Multiple profiles from the same extruder
- Generation of pressure needed by downstream devices

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## Pressure Before and After Pump Installation



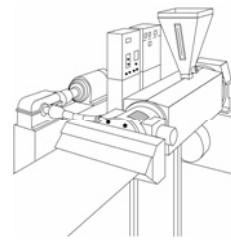
## Payback

OUTPUT POUNDS PER HOUR	MATERIAL COST, CENTS PER POUND											
	25	30	35	40	45	50	55	60	65	70	75	80
50	750	900	1050	1200	1350	1500	1650	1800	1950	2100	2250	2400
100	1500	1800	2100	2400	2700	3000	3300	3600	3900	4200	4500	4800
150	2250	2700	3150	3600	4050	4500	4950	5400	5850	6300	6750	7200
200	3000	3600	4200	4800	5400	6000	6600	7200	7800	8400	9000	9600
250	3750	4500	5250	6000	6750	7500	8250	9000	9750	10500	11250	12000
300	4500	5400	6300	7200	8100	9000	9900	10800	11700	12600	13500	14400
350	5250	6300	7350	8400	9450	10500	11550	12600	13650	14700	15750	16800
400	6000	7200	8400	9600	10800	12000	13200	14400	15600	16800	18000	19200
450	6750	8100	9450	10800	12150	13500	14850	16200	17550	18900	20250	21600
500	7500	9000	10500	12000	13500	15000	16500	18000	19500	21000	22500	24000
550	8250	9900	11550	13200	14850	16500	18150	19800	21450	23100	24750	26400
600	9000	10800	12600	14400	16200	18000	19800	21600	23400	25200	27000	28800
650	9750	11700	13650	15600	17550	19500	21450	23400	25350	27300	29250	31200
700	10500	12600	14700	16800	18900	21000	23100	25200	27300	29400	31500	33600
750	11250	13500	15750	18000	20250	22500	24750	27000	29250	31500	33750	36000
800	12000	14400	16800	19200	21600	24000	26400	28800	31200	33600	36000	37400
850	12750	15300	17850	20400	22950	25500	28050	30600	33150	35700	38250	39800
900	13500	16200	18900	21600	24300	27000	29700	32400	35100	37800	40500	42200
950	14250	17100	19950	22800	25650	28500	31350	34200	37050	39900	42750	44600
1000	15000	18000	21000	24000	27000	30000	33000	36000	39000	42000	45000	47000

## System Components

- Gear Pump
- Variable speed drive package
  - AC or DC...1 HP/100PPH
- Support cart/frame
- Process adapters
- Control system
  - Discrete instruments, PLC or combination

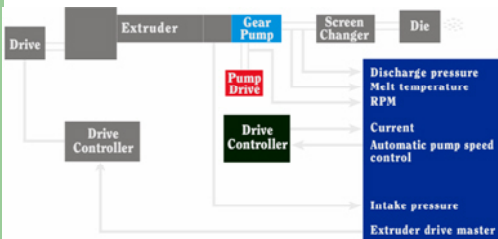
## Pump on Extruder with Controls and Drive



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## Standard Control System

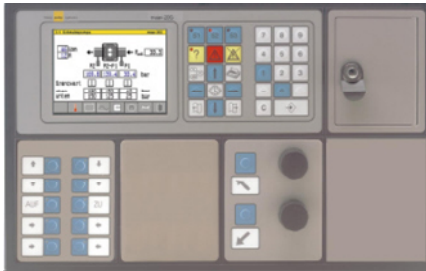
Gear Pump with extruder and controller



## Control Packages - Basic



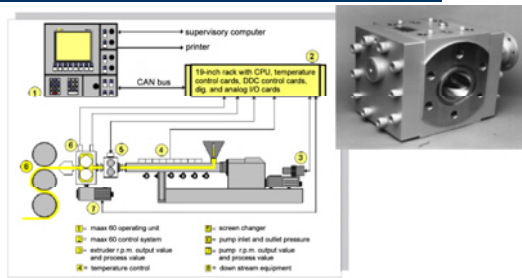
## Control Packages - Expanded



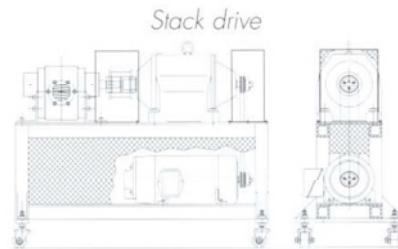
## Control Packages - Line



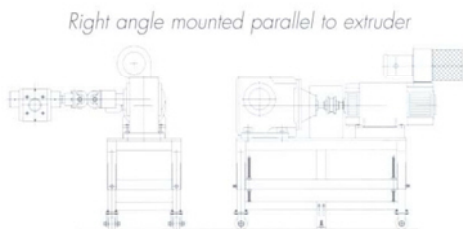
## Control Packages – Line, cont.



## Configurations



## Configurations, cont.



## Extruder Types

- Single Screw - Fair mixing, good pumping, questionable metering abilities
- Counter rotating twin screw - Good pumping, poor mixing
- Co rotating twin screw - Good mixing, poor pumping

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For co rotating multiple screw extruders, the pump offers advantages over the single screw devices as a pressure generator:

- Better metering accuracy
- Better energy efficiency - uses less than 50% of power compared to single screw
- Lower temperature rise
- Smaller footprint
- Lower investment cost

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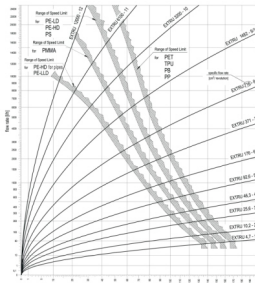
## Application

### Typical applications of extrex® gear pumps

Application Product	Pressure pipes PE-HD	Thermoformed sheets PS	Thermoformed sheets PP	
Viscosity at 10-1 (Pas)	3,000-5,000	1,500-2,500	1,000-2,000	
Diff. pressure (psibar)	2,610 / 180	1,740 / 120	1,885 / 130	
Density (g/cm <sup>3</sup> )	0.75	0.93 / 0.90	0.73	
gear pump	cm /rev	(Rpm) (lbs/h / kg/h)	(Rpm) (lbs/h / kg/h)	(Rpm) (lbs/h / kg/h)
extrex® 20	150	13 / 6	150 22 / 10	150 18 / 8
extrex® 21	2.5	120 31 / 14	150 46 / 21	150 35 / 16
extrex® 22	4.7	120 51 / 23	150 79 / 36	150 62 / 28
extrex® 28	10.2	110 99 / 45	140 158 / 72	140 128 / 58
extrex® 36	25.6	100 231 / 105	130 370 / 168	130 286 / 130
extrex® 45	46.3	95 396 / 180	115 594 / 270	120 484 / 220
extrex® 56	92.6	80 660 / 300	105 1,078 / 490	110 902 / 410
extrex® 70	176	70 1,100 / 500	95 1,870 / 850	100 1,562 / 710
extrex® 90	371	60 1,980 / 900	80 3,300 / 1,500	90 2,970 / 1,350
extrex® 110	716	50 3,190 / 1,450	70 5,588 / 2,540	80 5,060 / 2,300
extrex® 140	1482	40 5,280 / 2,400	60 9,900 / 4,500	70 9,152 / 4,160

This selection of pump rpm depends on the operating conditions. Dry running should be avoided!

## Pump Sizing/Selection



## Typical System Pricing

- System pricing including:
  - Gear pump, drive, support and control
- 500 PPH
  - \$ 30,000
- 3000 PPH
  - \$ 55,000



## Extrusion Pump Suppliers

Company	Gear Pump Products	Location
JLS International	Pump Systems, Static Mixers, Screen Changers, Filtration Systems	Charlotte, NC
Dynisco Extrusion	Pump Systems, Static Mixers, Screen Changers	Hickory, NC
Kreyenborg GmbH	Pump Systems, Static Mixers, Screen Changers	Lawrenceville, GA
PSI - Polymer Systems, Inc.	Pump Systems, Static Mixers, Screen Changers	Hickory, NC
MAAG Pump Systems	Pump Systems, Static Mixers, Screen Changers	Charlotte, NC
Zenith Pumps	Pump Systems	Sanford, NC