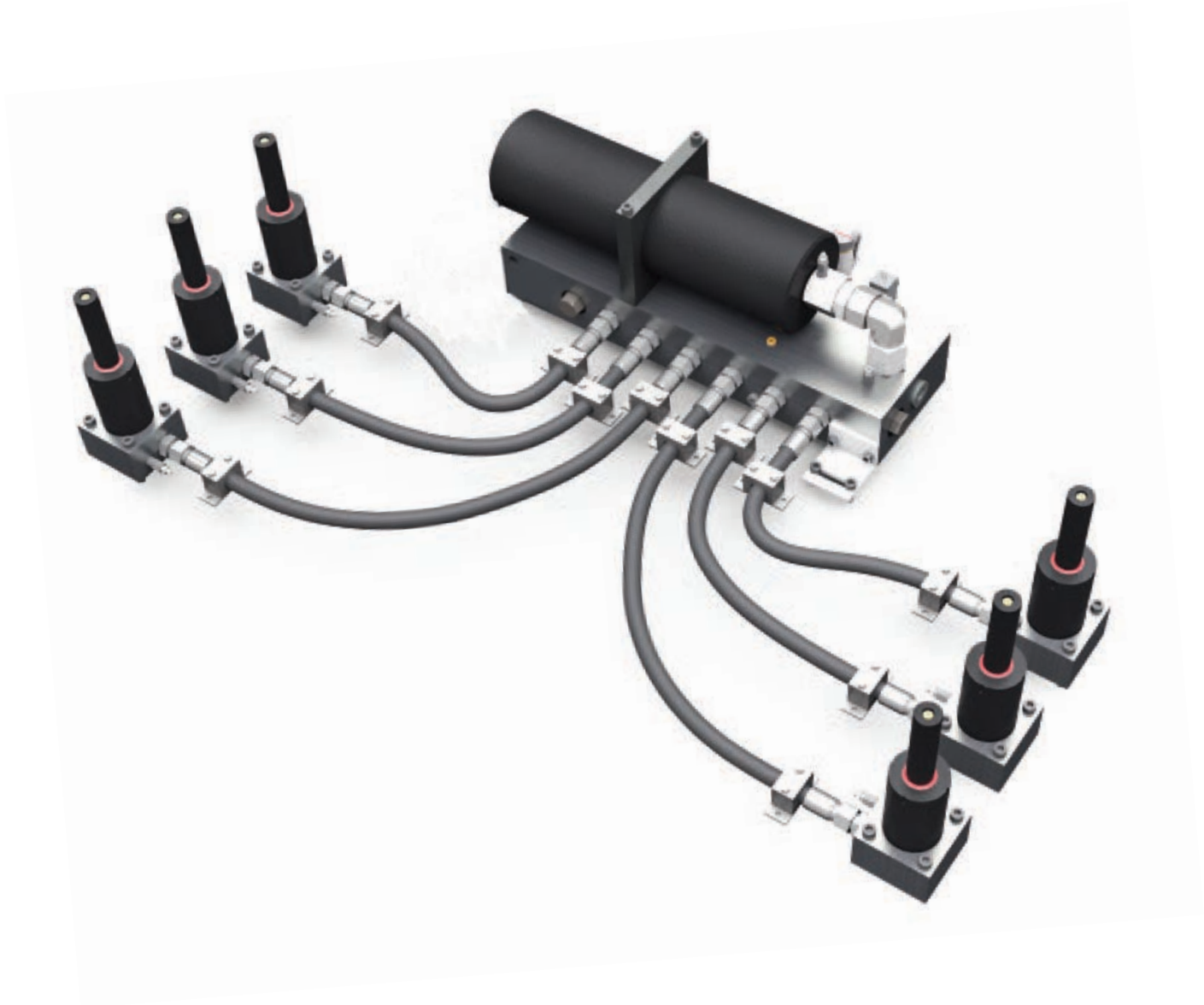


DI-DRO ADVANCED FORMING SYSTEMS



HYSON
Metal Forming Solutions™

WE PARTNER WITH YOU

We partner with you to provide force-generating products and solutions to lower your costs and increase your productivity in the forming of manufactured parts.

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A HISTORY OF INNOVATION

HYSON Metal Forming Solutions designed and manufactured the first pneumatic die cylinder, rated at 80 psi, in 1939. From that auspicious start, we continued to expand the technology of force to answer customer needs, developing the first nitro-gen gas spring in 1964 and delivering the first nitrogen manifold system that same year. A recognized leader in nitrogen gas systems, HYSON added hydraulic systems with the acquisition of the Di-Dro Advanced Forming System which combines high force in a small space and no pressure rise. Since the acquisition in 2007, HYSON engineers have enhanced and redesigned the product to include both modular and custom-engineered systems with a maximum force of 4000 psi.

HYSON brands, including Nitro-Dyne® and Tanker®, are well-respected throughout the industry, and our ISO 9001-2008 and PED certifications attest to our ongoing commitment to the highest standards of quality.

HYSON is backed by the financial strength and long history of Barnes Group Inc. (NYSE:B), a diversified global manufacturer and logistical services company focused on providing precision component manufacturing and operating service support. Founded in 1857, Barnes Group Inc. employs approximately 5,000 worldwide.

SOLUTIONS DESIGNED AROUND YOU

HYSON remains at the forefront of technical innovation, developing force-generating products and services across a wide range of industries and applications. Our success lies with our ability to establish long-term relationships and to offer tailored solutions to meet customer needs.

Our strength stems from working closely with you to create value and to provide support from design and production through installation and service. We have the experience and expertise to do just that, and our engineering team and sales and service personnel are ready for your call.

— 2011

Modular Di-Dro
Advanced
Forming System

— 2007

Di-Dro Advanced
Forming System
4000 psi

— 1985

Tanker®
High-Performance
Self-Contained
Nitrogen Gas Spring
2175 psi

— 1972

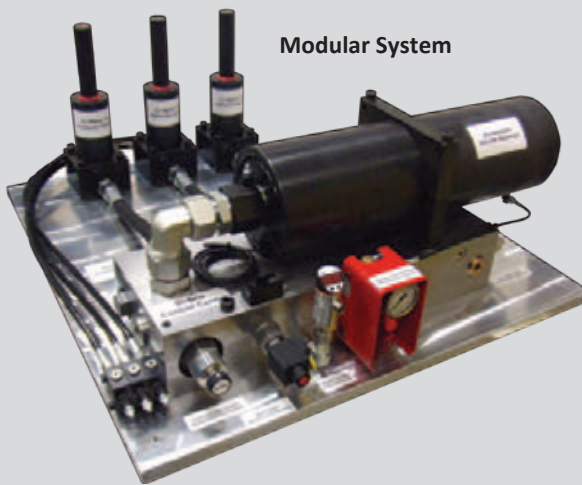
Super Nitro-Dyne®
Nitrogen Manifold
1500/2000 psi

— 1960

Nitro-Dyne®
Nitrogen Manifold
650 psi

— 1939

Pneumatic
Die Cylinder
80 psi



Modular System



Custom-Designed System

FORCE-GENERATING SOLUTIONS

HYSON offers a complete line of modular Di-Dro Advanced Forming Systems as well as custom-designed systems.

FEATURES & BENEFITS

HIGH FORCE HYDRAULIC SYSTEM

High force produced in a small footprint, up to 125.5 kN/14.1 tons with a single cylinder.

DELAYED RETURN

Cylinders delay in the retracted position to prevent parts from being inverted or interfering with automation.

LOW CONTACT AND RETURN FORCE

A soft hit and very low return force decrease press wear and extend press life.

CONSTANT FORCE

No pressure rise provides constant force throughout the stroke for better control of part quality.

SYSTEM VERSATILITY

Used in both upper and lower operations.

CYLINDER FLEXIBILITY

When space is a constraint, the modular system provides cylinders in individual bases that can be hoses to a control center with hose lengths as long as 2 m/80 in.

BORE SEAL CYLINDERS

Corrosion-resistant cylinders withstand contamination and leakage from rod damage for longer performance life.

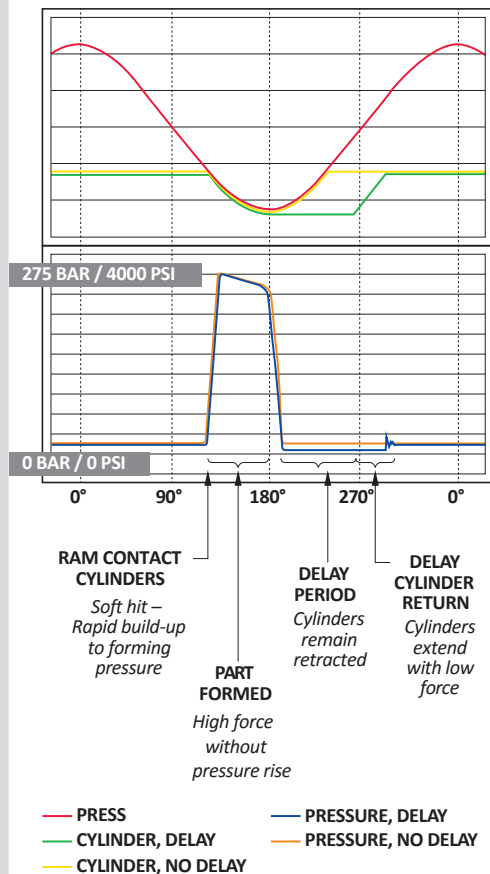
SELF-ALIGNING PISTON RODS

Cylinders accept some die movement and a degree of sideload without affecting performance.

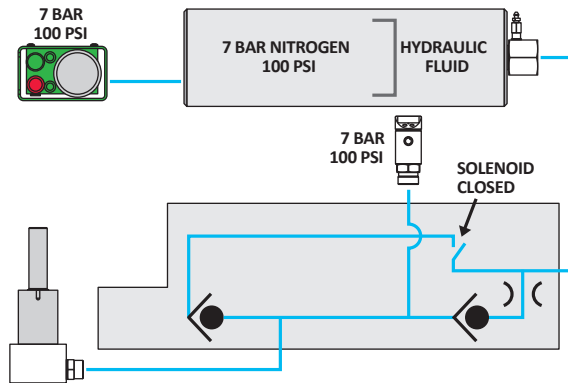
SELF-CONTAINED OPTION

System provided fully filled, bled and ready for installation.

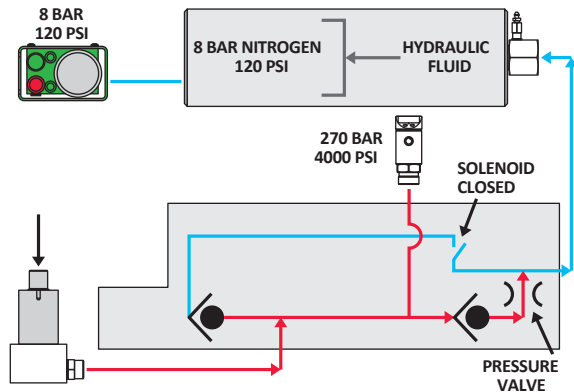
PRESSURE CURVE BENEFITS VS. PRESS CYCLE



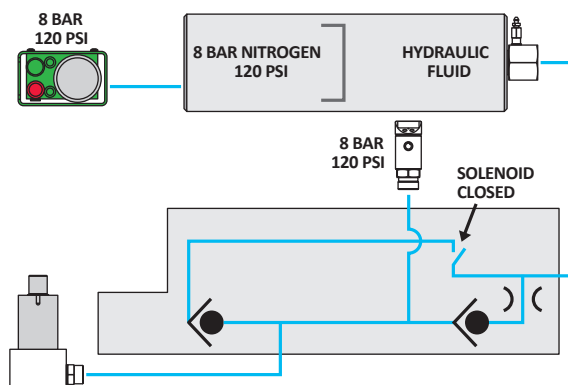
HOW IT WORKS



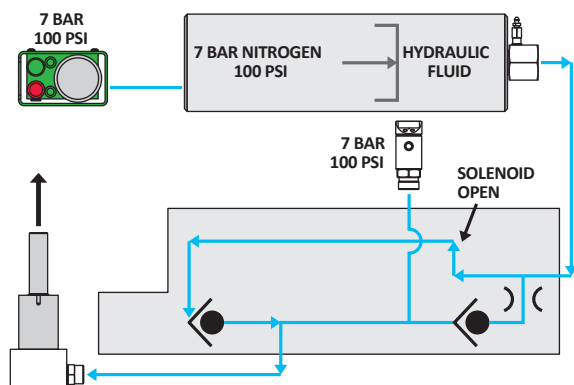
- 1 Cycle begins with system at low pressure (7 bar/100 psi) and solenoid closed.



- 2 When the cylinder is compressed, the pressure valve creates forming force. Fluid from the cylinder moves to the accumulator. High pressure occurs only while the cylinder is being compressed.



- 3 Cylinder is delayed in the retracted position as long as the solenoid is closed.



- 4 The solenoid opens and nitrogen pressure in the accumulator pushes fluid back to the cylinder which returns to the raised position. The system is reset and ready for the next cycle.

CASE STUDIES



APPLICATION: Automotive stampings.

CHALLENGE: Delay found to be required for this application. Space constraints occurred because die was designed for use with gas springs.

SOLUTION: In-die modular hoses system with delay.

ROI: Di-Dro retrofitted in original die, so no new die required.

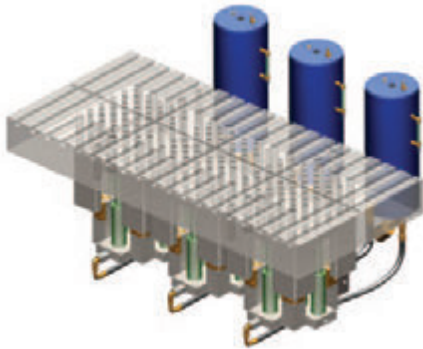
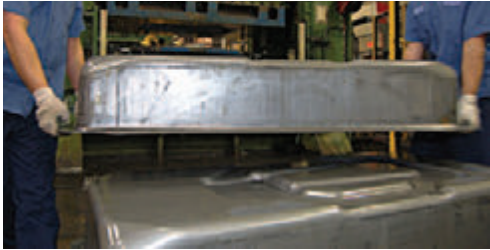


APPLICATION: Vehicle frame component with hat-shaped cross section.

CHALLENGE: Deep draw resulted in part deformation.

SOLUTION: In-die upper system with delay.

ROI: Improved part quality.



APPLICATION: Heavy metal stampings.

CHALLENGE: Air cushions needed repair or replacement.

SOLUTION: In-press bolster cushion with delay.

ROI: Significant cost savings on initial investment.



APPLICATION: Stainless steel stove top.

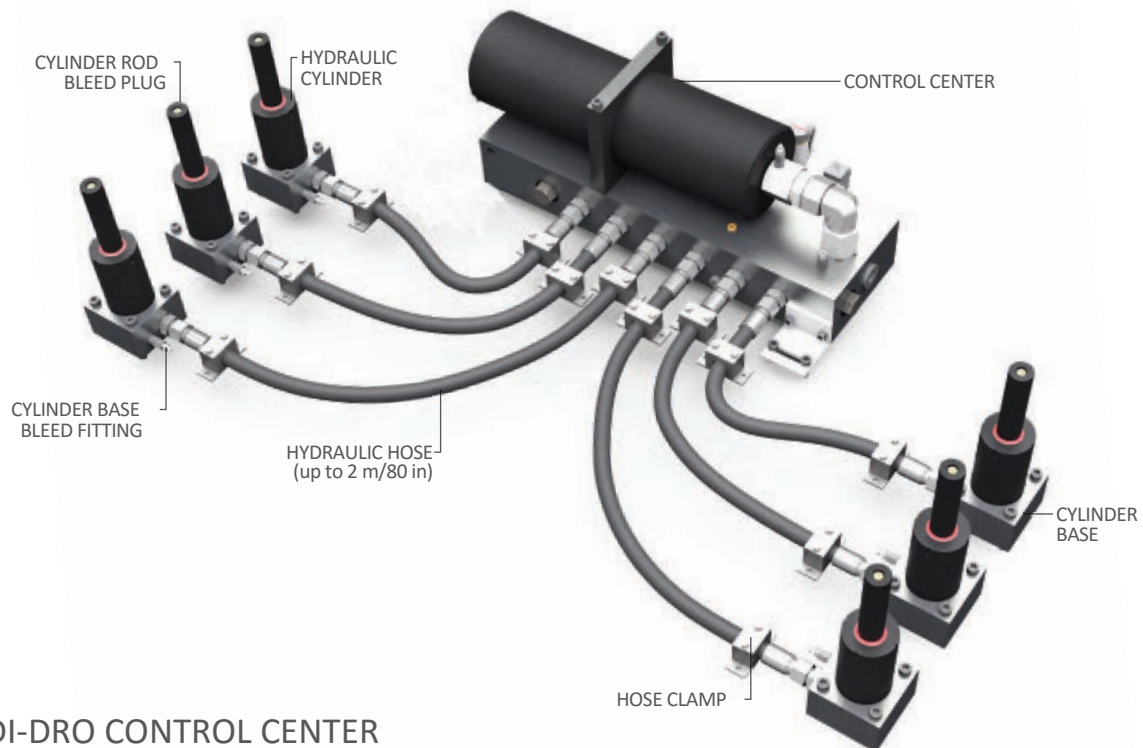
CHALLENGE: Required programmable cushion for the die.

SOLUTION: In-die lower deep draw with delay.

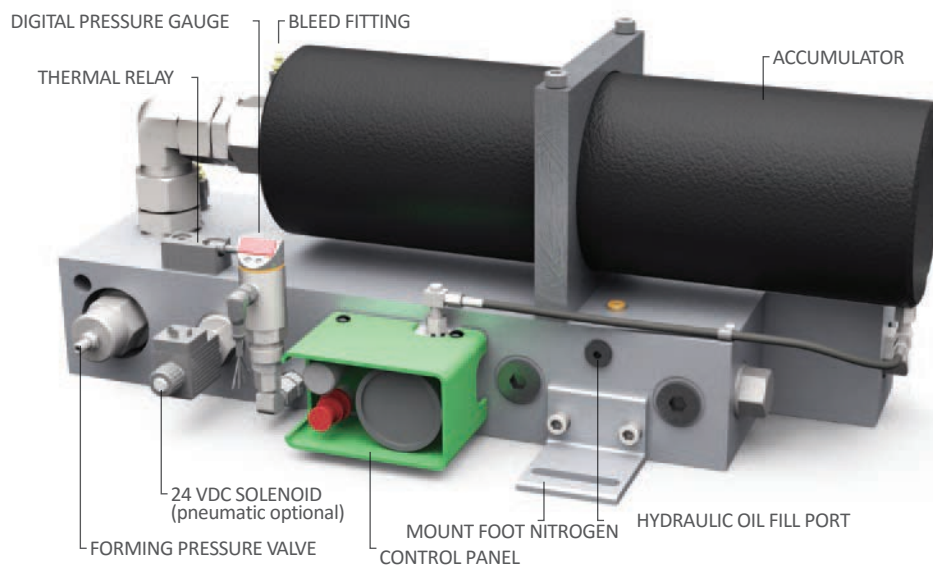
ROI: Eliminated need and cost for programmable cushion.

COMPONENTS

MODULAR DI-DRO SYSTEM



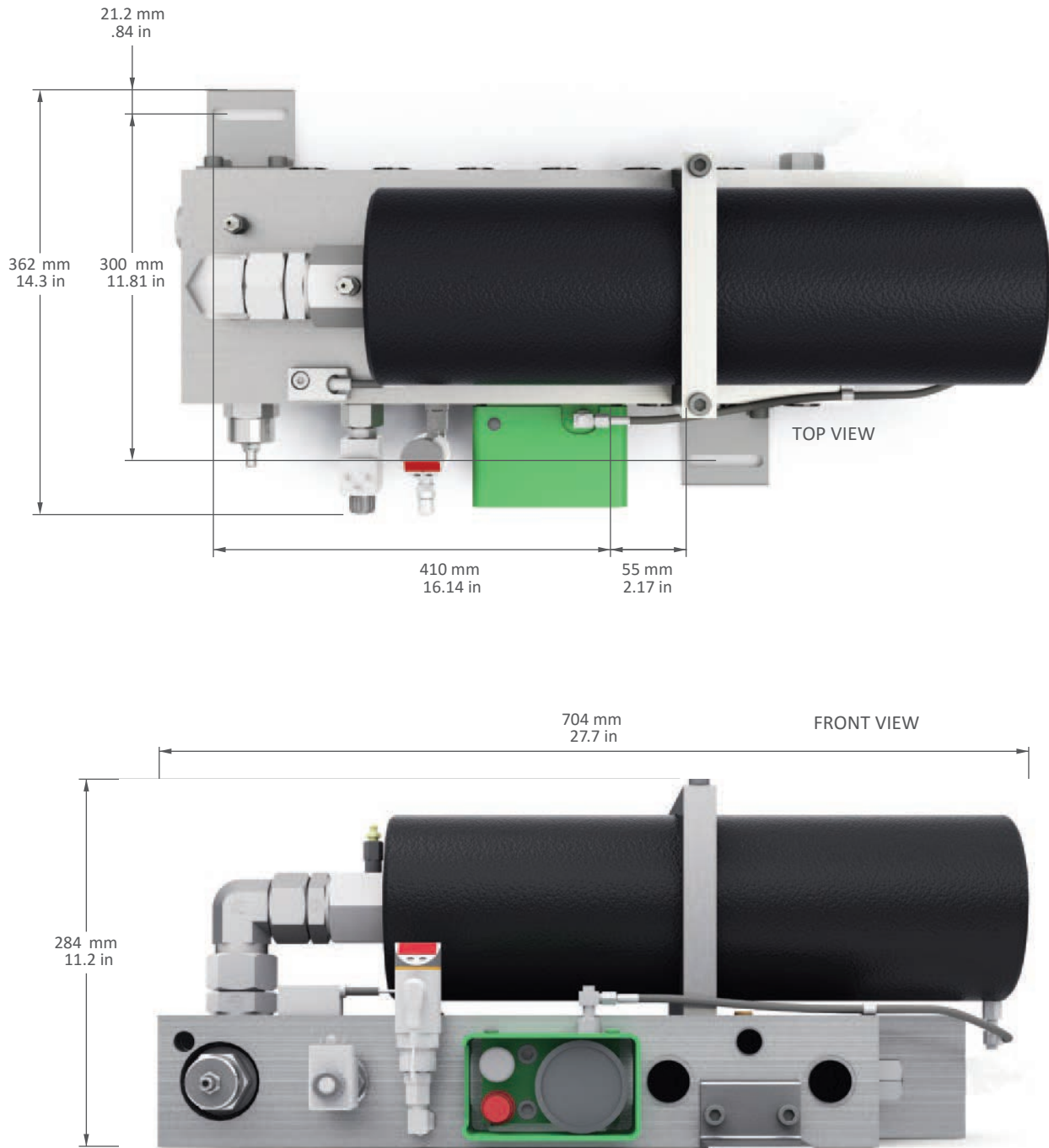
DI-DRO CONTROL CENTER



MODULAR DI-DRO SYSTEM CONFIGURATIONS

- Standard (with Delay)
- Force-Only System (No Delay)
- Low Pressure System
- Pneumatic Delay
- Cooling

DIMENSIONAL INFORMATION: CONTROL CENTER



DIMENSIONAL INFORMATION: CYLINDERS

PRESSURE MEDIUM	Hydraulic Oil
MAXIMUM PRESSURE	275 bar/4000 psi
MINIMUM PRESSURE	25 bar/360 psi
MAX. OPERATING TEMP.MAX.	93°C/200°F
PISTON ROD VELOCITY	96 m/min/315 ft/min

MAX. UTILIZED STROKE	100%
MAX. STROKES PER MINUTE	Dependant on Heat
BASE BLEED FITTING	4014007
CYLINDER ROD BLEED PLUG	NF-771-3-V-ZLG

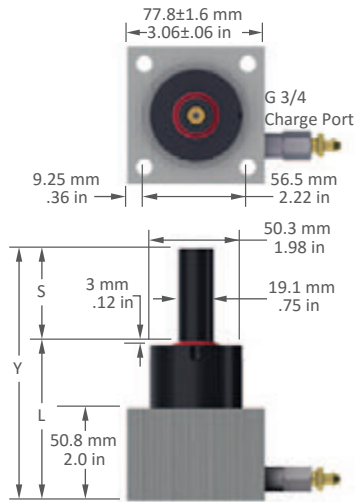
PRODUCT SPECIFICATIONS

REPAIR KIT 54-112-7000

CYLINDER BASE 54-112-0300

FORCE 1780-17790 N 0.2-2.0 TONS
MOUNT SCREWS M8

DDNB 1000



HYSON PART NUMBER	STROKE (mm) (in)	L (mm) (in)	Y (mm) (in)	MAX QTY (per system)
DDNB-1000X13	13 0.51	63 2.48	76 2.99	6
DDNB-1000X16	16 0.63	63 2.48	79 3.11	6
DDNB-1000X19	19 0.75	63 2.48	82 3.23	6
DDNB-1000X25	25 0.98	63 2.48	88 3.46	6
DDNB-1000X32	32 1.26	70 2.76	102 4.02	6
DDNB-1000X38	38 1.50	76 2.99	114 4.49	6
DDNB-1000X50	50 1.97	88 3.46	138 5.43	6
DDNB-1000X63	63 2.48	101 3.98	164 6.46	6
DDNB-1000X75	75 2.95	113 4.45	188 7.40	6
DDNB-1000X80	80 3.15	118 4.65	198 7.80	6
DDNB-1000X100	100 3.94	138 5.43	238 9.37	6
DDNB-1000X125	125 4.92	163 6.42	288 11.34	6
DDNB-1000X150	150 5.91	201 7.91	351 13.82	6
DDNB-1000X175	175 6.89	226 8.90	401 15.79	6
DDNB-1000X200	200 7.87	251 9.88	451 17.76	6

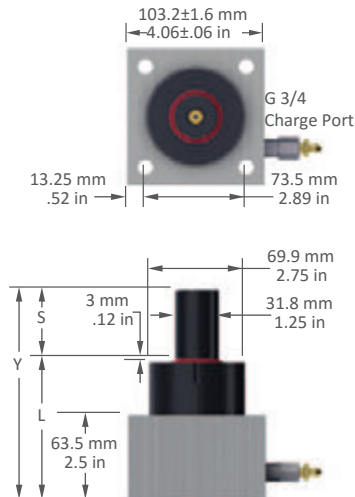
PRODUCT SPECIFICATIONS

REPAIR KIT 54-175-7000

CYLINDER BASE 54-175-0300

FORCE 4450-42700 N 0.5-4.8 TONS
MOUNT SCREWS M10

DDNB 2400



HYSON PART NUMBER	STROKE (mm) (in)	L (mm) (in)	Y (mm) (in)	MAX QTY (per system)
DDNB-2400X16	16 0.63	80 3.15	96 3.78	6
DDNB-2400X19	19 0.75	80 3.15	99 3.90	6
DDNB-2400X25	25 0.98	80 3.15	105 4.13	6
DDNB-2400X32	32 1.26	87 3.42	119 4.68	6
DDNB-2400X38	38 1.50	93 3.66	131 5.16	6
DDNB-2400X50	50 1.97	105 4.13	155 6.10	6
DDNB-2400X63	63 2.48	118 4.65	181 7.13	6
DDNB-2400X75	75 2.95	130 5.12	205 8.07	6
DDNB-2400X80	80 3.15	135 5.31	215 8.46	6
DDNB-2400X100	100 3.94	155 6.10	255 10.04	6
DDNB-2400X125	125 4.92	180 7.09	305 12.01	6
DDNB-2400X150	150 5.91	216 8.50	366 14.41	6
DDNB-2400X175	175 6.89	241 9.49	416 16.38	6
DDNB-2400X200	200 7.87	266 10.47	466 18.35	6

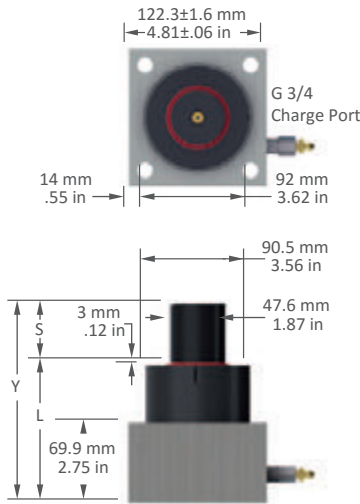
PRODUCT SPECIFICATIONS

REPAIR KIT 54-238-7000

CYLINDER BASE 54-238-0300

FORCE 7120-78290 N 0.8-8.8 TONS
MOUNT SCREWS M12

DDNB 4200



HYSON PART NUMBER	STROKE (mm) (in)	L (mm) (in)	Y (mm) (in)	MAX QTY (per system)
DDNB-4200X16	16 0.63	89 3.50	105 4.13	6
DDNB-4200X19	19 0.75	92 3.62	111 4.37	6
DDNB-4200X25	25 0.98	98 3.86	123 4.84	6
DDNB-4200X32	32 1.26	105 4.13	137 5.39	6
DDNB-4200X38	38 1.50	111 4.37	149 5.87	6
DDNB-4200X50	50 1.97	123 4.84	173 6.81	6
DDNB-4200X63	63 2.48	136 5.35	199 7.83	6
DDNB-4200X75	75 2.95	148 5.83	223 8.78	6
DDNB-4200X80	80 3.15	153 6.02	233 9.17	6
DDNB-4200X100	100 3.94	173 6.81	273 10.75	6
DDNB-4200X125	125 4.92	198 7.79	323 12.72	5
DDNB-4200X150	150 5.91	236 9.29	386 15.20	4
DDNB-4200X175	175 6.89	261 10.28	436 17.16	4
DDNB-4200X200	200 7.87	286 11.26	486 19.13	3
DDNB-4200X225	225 8.86	311 12.24	536 21.10	3

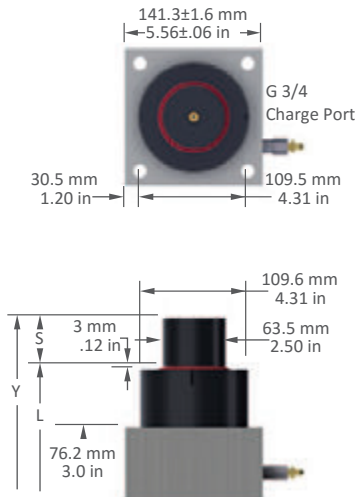
PRODUCT SPECIFICATIONS

REPAIR KIT 54-300-7000

CYLINDER BASE 54-300-0300

FORCE 11565-125440 N 1.3-14.1 TONS
MOUNT SCREWS M12

DDNB 6600



HYSON PART NUMBER	STROKE (mm) (in)	L (mm) (in)	Y (mm) (in)	MAX QTY (per system)
DDNB-6600X16	16 0.63	104 4.09	120 4.72	6
DDNB-6600X19	19 0.75	107 4.21	126 4.96	6
DDNB-6600X25	25 0.98	113 4.45	138 5.43	6
DDNB-6600X32	32 1.26	120 4.72	152 5.98	6
DDNB-6600X38	38 1.50	126 4.96	164 6.46	6
DDNB-6600X50	50 1.97	138 5.43	188 7.40	6
DDNB-6600X63	63 2.48	151 5.94	214 8.42	6
DDNB-6600X75	75 2.95	163 6.42	238 9.37	6
DDNB-6600X80	80 3.15	168 6.61	248 9.76	5
DDNB-6600X100	100 3.94	188 7.40	288 11.34	4
DDNB-6600X125	125 4.92	213 8.39	338 13.31	3
DDNB-6600X150	150 5.91	251 9.88	401 15.79	3
DDNB-6600X175	175 6.89	276 10.87	451 17.76	2
DDNB-6600X200	200 7.87	301 11.85	501 19.72	2
DDNB-6600X225	225 8.86	326 12.83	551 21.69	2

HOSE & FITTINGS & ACCESSORIES

Select the correct hose and fittings for optimum performance for your modular Di-Dro system.

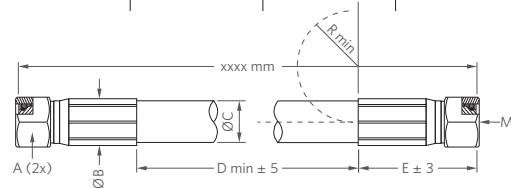
HOSE

MAXIMUM WORKING PRESSURE 280 bar/4060 psi MINIMUM BURST PRESSURE 1120 bar/16240 psi

HYSON PART NUMBER	HOSE SIZE	THREAD	A (mm) (		B (mm) (		C (mm) (		D min (mm) (		E (mm) (		R min (mm)	
30 214 54-xxxx	½-in.	M24x1.5	30	1.18	28.5	1.12	24	0.94	50	1.97	63	2.48	90	3.54
30 214 55-xxxx	¾-in.	M30x2	36	1.42	35	1.38	31	1.22	50	1.97	72	2.83	120	4.72

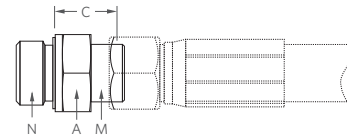
ADDITIONAL PARKER SPECIFICATIONS

PARKER PART NUMBER	HOSE SIZE	INNER Ø (mm) (	OUTER Ø (mm) (	HOSE FITTING PART NUMBER
721TC-8	½-in.	12.5 0.49	24 0.94	1C971-16-8
721TC-12	¾-in.	19 0.75	31 1.22	1C971-20-12



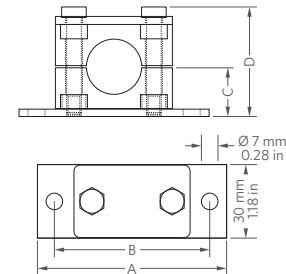
HOSE FITTING

HYSON PART NUMBER	HOSE SIZE	THREAD M	T N	A (mm) (		C (mm) (
504321	½-in.	M24x1.5	G ½	27	1.06	19	0.75
504322	½-in.	M24x1.5	G ¾	32	1.26	21	0.83
504324	¾-in.	M30X2	G ¾	32	1.26	21	0.83

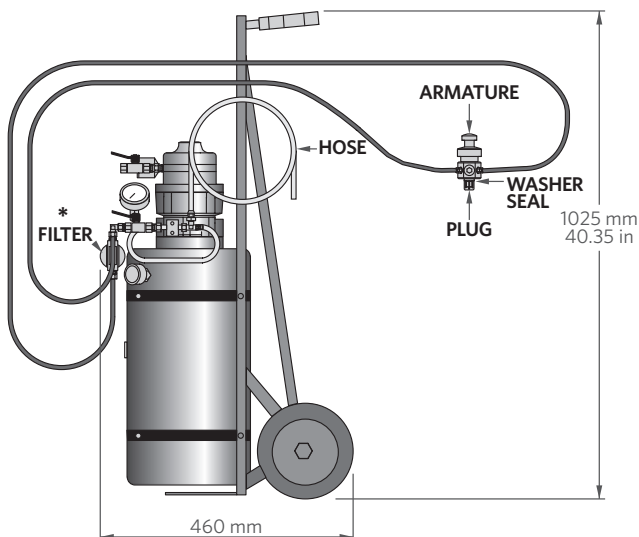


HOSE CLAMP

HYSON PART NUMBER	HOSE SIZE	A (mm) (		B (mm) (		C (mm) (		D (mm)	
504614	½-in.	78	3.07	64	2.52	20	0.79	44	1.73
504615	¾-in.	87	3.43	73	2.87	24	0.94	51	2.01



HYDRAULIC FILL AND BLEED SYSTEM



Required to properly fill the Di-Dro unit with oil and remove air from the system. Trapped air causes low forming pressure and a lack of delay.

HYSON PART NUMBER 3017075

OIL FLOW 2.4 L/MIN AT 1500 RPM

MAX. OIL PRESSURE 55 BAR/800 PSI

TANK VOLUME 18 LITERS

OIL FILTER 10 µm

AIR PRESSURE 5-7 BAR/73-100 PSI

*Replacement Filter 505763

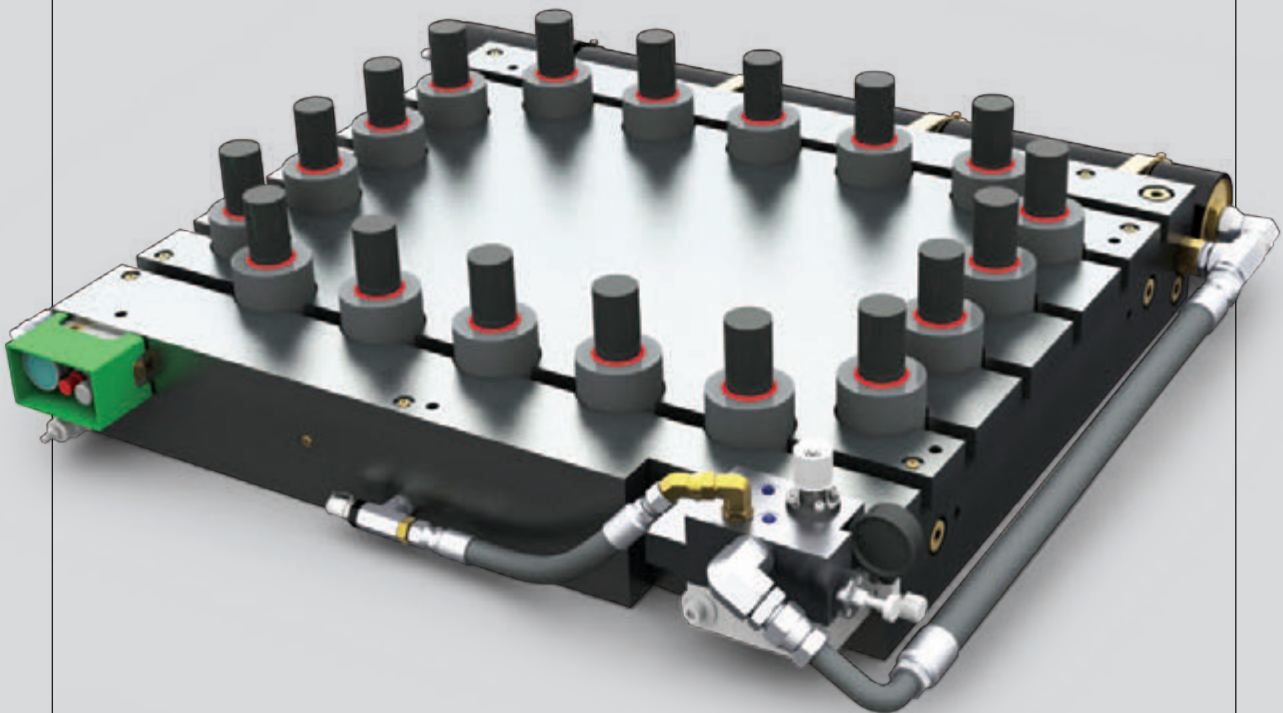
CUSTOM DI-DRO ADVANCED FORMING SYSTEMS

While our modular Di-Dro system is the solution for most applications, HYSON also offers custom-engineered Di-Dro systems when needed.

Consider a custom-engineered system when the application requires:

- A large number of cylinders or pressure points
- Very high force
- Cylinders integrated into the die shoe
- A ram cushion with delay capability
- A bolster cushion with delay capability

The Advanced Engineered Systems Group at HYSON is ready to partner with you to develop an integrated solution for your forming needs.



HOW TO GET STARTED

To provide the system to fit your needs, complete the required short form. You may choose to complete the long form which includes equations that will allow you to select your system components.

Email to Orders@HysonSolutions.com or fax to 440-526-6807. For more information or to request these forms in English measures, call toll-free 800-876-4976 or 440-526-5900.

SHORT FORM (required)

- | | |
|------------------------------------|--|
| 1. Number of pressure points _____ | 5a. Maximum ram speed during work stroke (m/s) _____ |
| 2. Total force required (N) _____ | or |
| 3. Cylinder work stroke (mm) _____ | 5b. Mechanical press stroke length (mm) _____ |
| 4. Parts per minute (ppm) _____ | 6. Maximum anticipated press speed in strokes per minute (spm) _____ |

LONG FORM (optional)

EQUATIONS

1. PRESSURE POINT FORCE (CYLINDER SIZE SELECTION)

$$\frac{\text{total force required (N)}}{\text{number of pressure points}} = \text{_____ (N)}$$

Notes: Choose a cylinder size (see right) where the calculated tonnage is within the cylinder's range, near mid-range is preferred. Smaller cylinder sizes preferred.

PART NUMBER	FORCE RANGE	PISTON AREA
<input type="checkbox"/> DDNB-1000x***	1780-17790 N	641 mm ²
<input type="checkbox"/> DDNB-2400x***	4450-42700 N	1552 mm ²
<input type="checkbox"/> DDNB-4200x***	7120-78290 N	2858 mm ²
<input type="checkbox"/> DDNB-6600x***	11565-125440 N	4560 mm ²

2. PRESSURE

$$\frac{\text{total force required (N)} \times 10}{\text{cyl. qty.} \times \text{piston area (mm}^2\text{)}} = \text{_____ bar}$$

Notes: Pressure MUST be less than 275 bar. **IF NOT:** 1. Increase quantity of cylinders. 2. Increase size of cylinders.

3. SYSTEM FLUID FLOW RATE

If maximum ram speed during cylinder work stroke is known:

$$\text{OR } \text{cyl. qty.} \times \text{piston area (mm}^2\text{)} \times \text{ram speed (m/s)} \times 0.06 = \text{_____ liters per minute (Lpm)}$$

If application is for a mechanical press, and stroke length and stroke per minute speed are known:

$$\frac{\text{cyl. qty.} \times \text{piston area (mm}^2\text{)} \times \text{spm} \times \text{press stroke (mm)}}{318310} \times \left(\sin \left(\cos^{-1} \left(\frac{2 \times \text{work stroke (mm)} - 1}{\text{press stroke (mm)}} \right) \right) \right) = \text{_____ Lpm}$$

Notes: System fluid flow rate MUST be less than 300 Lpm. **IF NOT:** 1. Reduce ram speed or strokes per minute.
2. Use smaller cylinders at higher pressure.
3. Use multiple systems.
4. Contact Hyson Products for custom Di-Dro options.

4. INDIVIDUAL CYLINDER FLUID FLOW RATE-HOSE SIZE SELECTION

$$\frac{\text{system fluid flow rate (Lpm)}}{\text{cylinder quantity}} = \text{_____ Lp}$$

Notes: If less than 57 Lpm, use ½-inch or ¾-inch hose.
If between 57 and 132 Lpm, use the ¾-inch hose only.
If more than 132 Lpm:

1. Reduce ram speed or strokes per minute.
2. Use smaller cylinders at higher pressure.
3. Use additional cylinders.
4. Contact Hyson Products for custom Di-Dro options.

5. HEAT GENERATION

$$\frac{\text{total force (N)} \times \text{work stroke (mm)} \times \text{parts per minute (ppm)}}{60,000,000} = \text{_____ kW}$$

Notes: Heat generation MUST be less than 2.93 kW **IF NOT:** 1. Reduce total tonnage, work stroke or parts per min.
2. Use multiple systems.
3. Contact Hyson Products for cooling options or custom Di-Dro options.

LONG FORM (continued)

COMPONENT SELECTION

CONTROL CENTER PART NUMBERS:

DD-CNTRL ASSY 1	Standard	70-275 bar with 24 VDC Delay
DD-CNTRL ASSY 3	No Delay	70-275 bar
DD-CNTRL ASSY 4	Low Pressure	25-70 bar with 24 VDC Delay
DD-CNTRL ASSY 5	Pneumatic Delay	70-275 bar with Air-Operated Delay Valve
DD-CNTRL ASSY 6	Cooling	70-275 bar with Oil Cooling Circuit

DETERMINE CYLINDER PART NUMBER AND QUANTITY:

- Use cylinder size (Equation 1 - 1000, 2400, 4200, 6600)
Cylinder fluid flow rate (Equation 4) must be less than 57 Lpm for DDNB-1000.
Cylinder fluid flow rate (Equation 4) must be less than 132 Lpm for DDNB-2400, 4200 and 6600.
- Stroke lengths range from 13 mm to 225 mm. See pages 10-11 for details.

PART NUMBER
DDNB-_____ x _____
cylinder size stroke
(example: DDNB-2400 x 50)

PART NUMBER _____

QUANTITY _____

DETERMINE HOSE PART NUMBER AND QUANTITY:

- Use hose 30 214 54-xxxx if cylinder fluid flow rate (Equation 4) is less than 57 Lpm.
- Use hose 30 214 55-xxxx if cylinder fluid flow rate (Equation 4) is 57-132 Lpm.
- Maximum hose length is 2000 mm.
- Use up to six (6) hose sizes per system. Note length and quantity for each hose required.
- See page 12 for details.

PART NUMBER _____

QUANTITY _____

DETERMINE FITTING PART NUMBER AND QUANTITY:

- Two fittings are required per cylinder (one for the cylinder, one for the control center).
- For DDNB-1000 cylinders:
(1) 504321 and (1) 504322.
- For DDNB-2400, 4200 and 6600 cylinders:
(2) 504322 or (2) 504324.
- See page 12 for details.

PART NUMBER _____

QUANTITY _____

DETERMINE HOSE CLAMP PART NUMBER AND QUANTITY:

- Use at least two (2) hose clamps per hose, positioning one near the cylinder and the other near the control center.
- Use 504614 for ½-in. ID hose.
- Use 504615 for ¾-in ID hose.
- See page 12 for details.

PART NUMBER _____

QUANTITY _____



www.HysonSolutions.com
E-mail: Orders@HysonSolutions.com

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