

# 2011液壓之發展與現況

For 陳文慶 博士

**Pascal Hydraulic**

**2011,11,18**

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- 液壓比例伺服系統
- 運動模擬與虛擬實境之系統整合

- 橡塑膠射出機 壓鑄機 伺服控制



# 資料來源

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□ 美商 

 閥, 泵

□ 美商 

精密過濾系統

□ 德商 

蓄壓器, 過濾及量測系統

□ 臺灣機器公會

# 液壓產業

- 北部 電子
- 中部 工具機
- 台南 射出機
- 高雄 鋼廠
- 石化廠



# 2010台灣機械出口

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- 總額5422億
- 香港 + 大陸 34.3%
- 美國 14.3%
- 日本 5.2%
- 泰國 3.5%
- 越南 3.4%
- 印尼 3.0%

# 機械出口產品

2008 2010年

台灣機械

單位：百萬NT

工具機932億

塑橡膠369億

閥291億

2010 名次	產品名 稱	2010年			2009年			2008年		
		金額	比率%	10/09 %	金額	比率%	09/08 %	金額	比率%	08/07 %
1	工具機	93,235	17.2%	162%	57,532	15.4%	49%	116,777	22.4%	103%
2	塑橡膠 機械	36,901	6.8%	150%	24,608	6.6%	72%	33,946	6.5%	103%
3	特殊功能 機械	35,346	6.5%	146%	24,248	6.5%	61%	39,484	7.6%	122%
4	泵，送風 機，壓縮 機	33,206	6.1%	152%	21,840	5.8%	77%	28,372	5.4%	94%
5	軸承，齒 輪，軸	29,212	5.4%	165%	17,738	4.7%	79%	22,351	4.3%	111%
6	閥類	29,163	5.4%	132%	22,087	5.9%	73%	30,145	5.8%	98%
7	印刷機械 造紙及紙 品機械	24,895	4.6%	167%	14,910	4.0%	86%	17,279	3.3%	91%
8	工具機零 組件	24,695	4.6%	181%	13,669	3.7%	63%	21,648	4.1%	104%
9	紡織機械 (縫紉機 除外)	18,278	3.4%	146%	12,558	3.4%	83%	15,103	2.9%	72%
10	木工機械	17,750	3.3%	149%	11,925	3.2%	63%	18,871	3.6%	84%
11	縫紉機 皮革及製 鞋機械	15,600	2.9%	151%	10,311	2.8%	74%	11,330	2.2%	90%
12	模具	14,472	2.7%	107%	13,539	3.6%	80%	16,878	3.2%	102%
13	食品及包 裝機械	13,218	2.4%	133%	9,926	2.7%	87%	11,471	2.2%	98%
	其他機械	156,289	28.8%	131%	119,181	31.9%	88%	135,641	26.0%	114%
	出口總值	542,260	100.0%	145%	374,072	100.0%	72%	521,940	100.0%	103%

# 2010台灣機械進口 8524億

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□ 日本	39.7%
□ 美國	21.6%
□ 香港 + 大陸	8.6%
□ 德國	7.0%
□ 韓國	3.5%
□ 義大利	1.2%

# 進口項目

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□ 半導體、IC、面板用製程設備	48.9%
□ 特殊功能之機械及用具	8.3%
□ 泵，送風機，壓縮機	4.4%
□ 引擎及零件	3.4%
□ 處理材料製程設備	3.4%
□ 機械零組件	2.9%
□ 工具機	2.6%
□ 閥類	2.4%

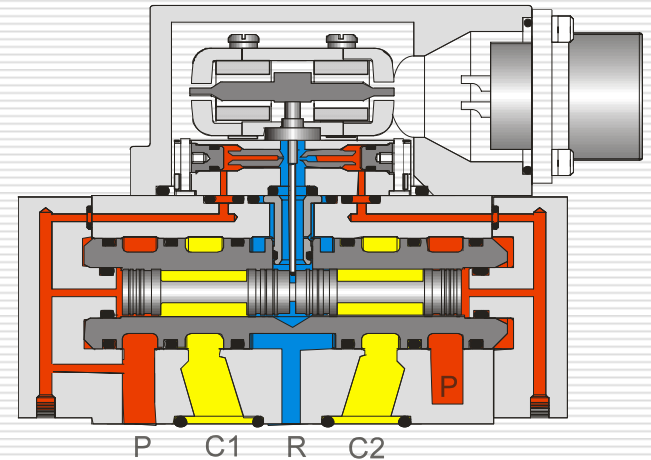


# Servo Valve 1940

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Actual standard Torque-Motor valves:

- Sensitive to Contamination
- High Filtration "On" costs
- First Stage Leakage (2 to 3 L/Min @ 210bar) >>  
heating, noise and power

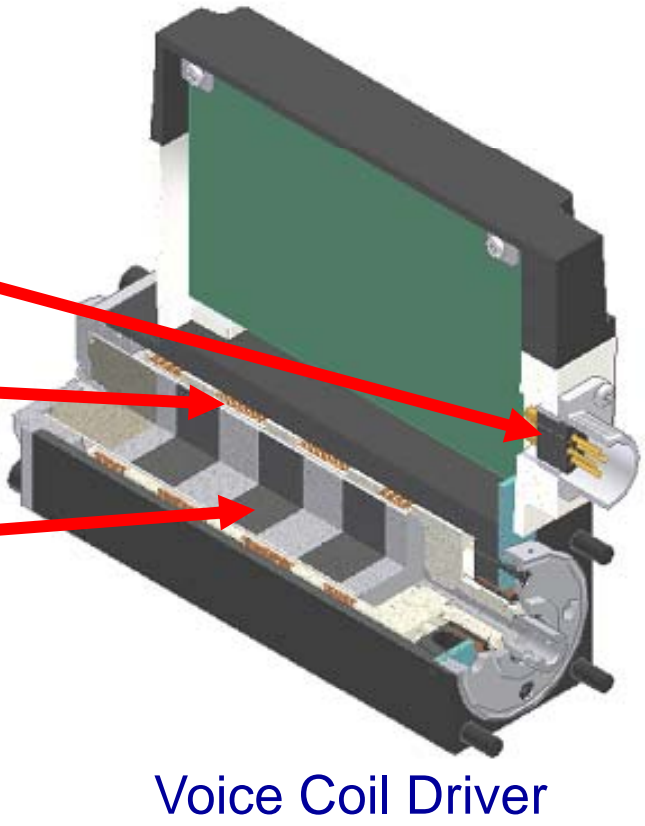
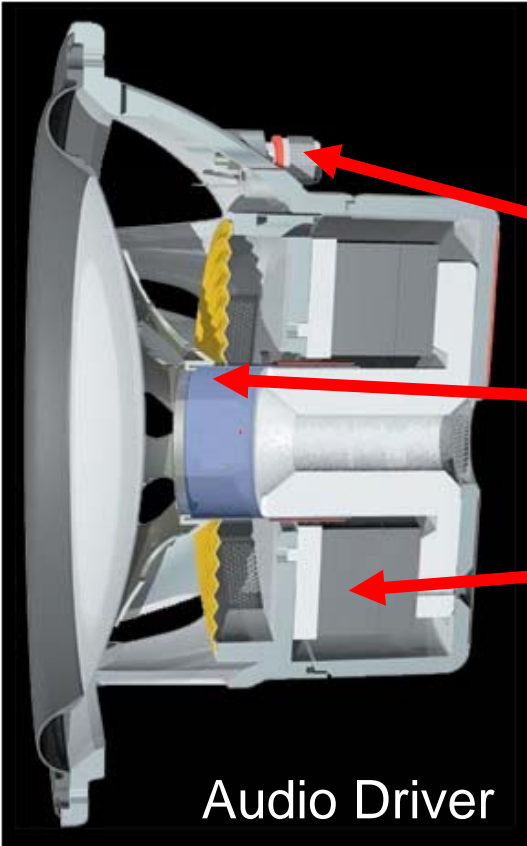


# Dynamics & Force

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# VCD<sup>®</sup>: Milestone for High Performance Valves



Plug

Coil

Magnet

# Next Generation Prop Valve

## - Specs, Single Stage

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### □ ISO-3 Size

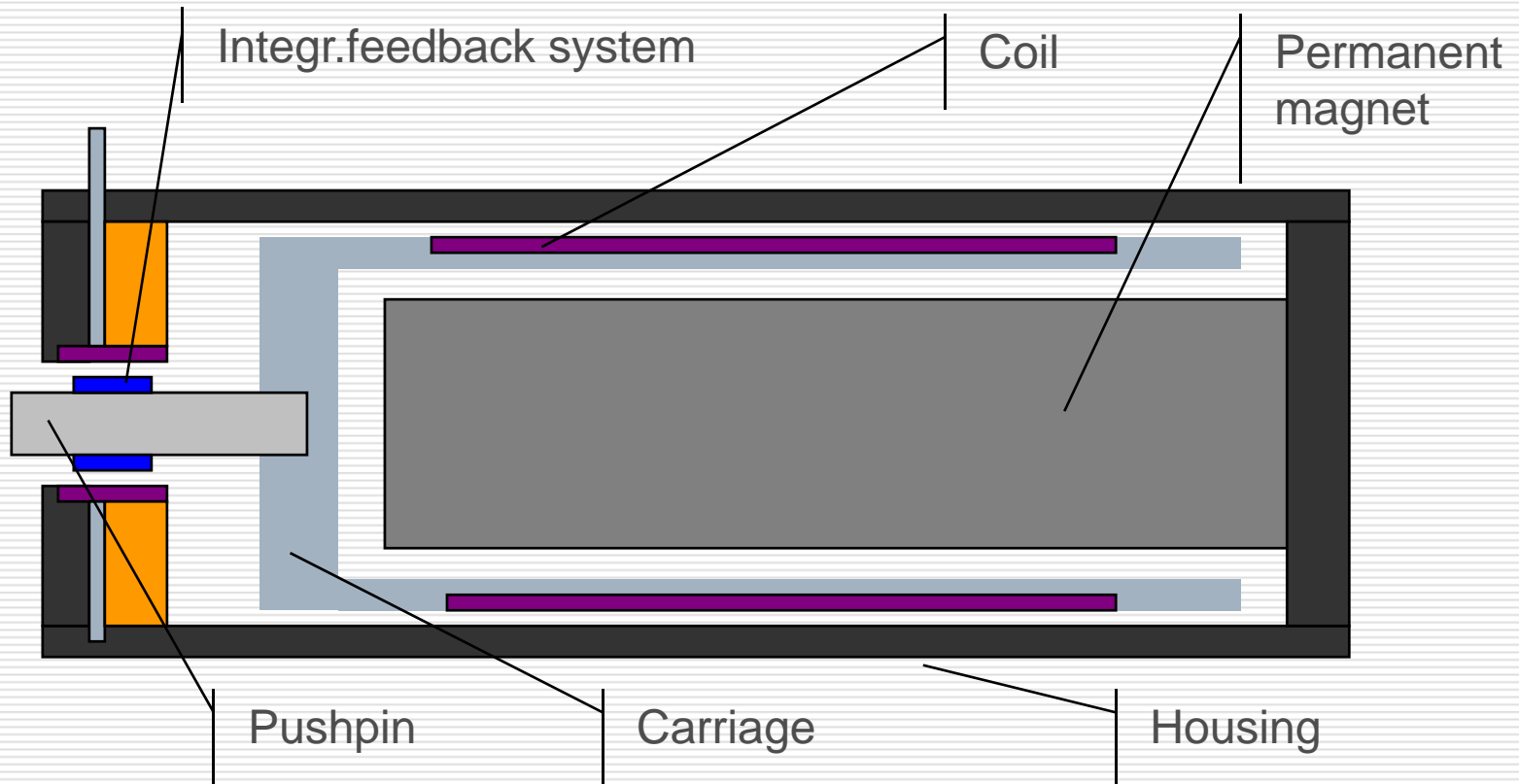
- Rated Flow: 40 LPM @ 70 bar
- Dynamic Bandwidth: 150 Hz
- Step Response: < 3.5 ms

### □ ISO-5 Size

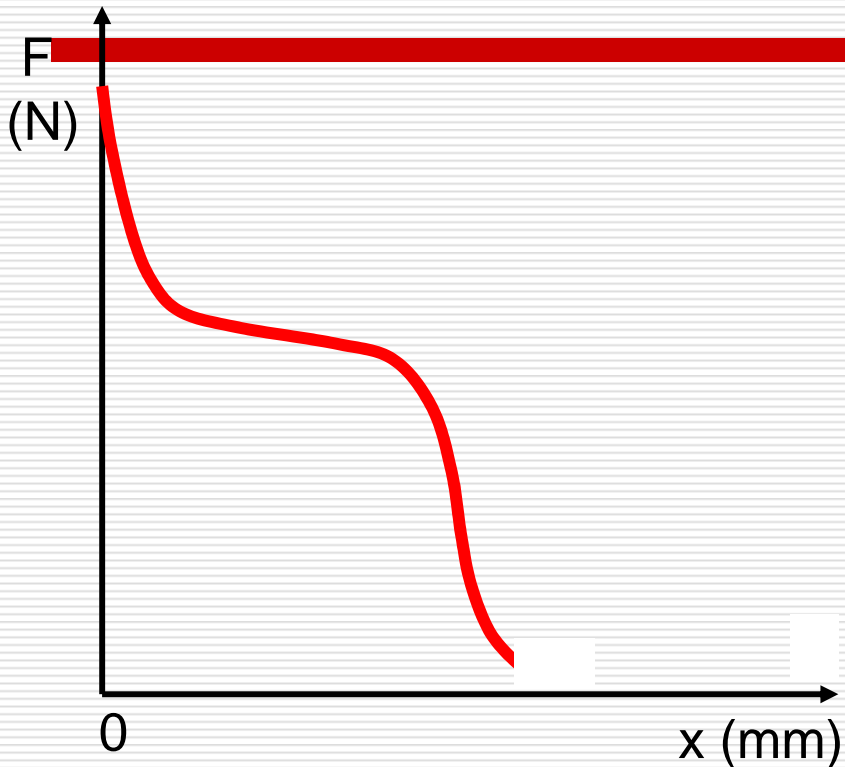
- Rated Flow: 100 LPM @ 70 bar
- Dynamic Bandwidth: 100 Hz
- Step Response: < 6 ms

# Parker Voice Coil Drive (VCD®) Technology:

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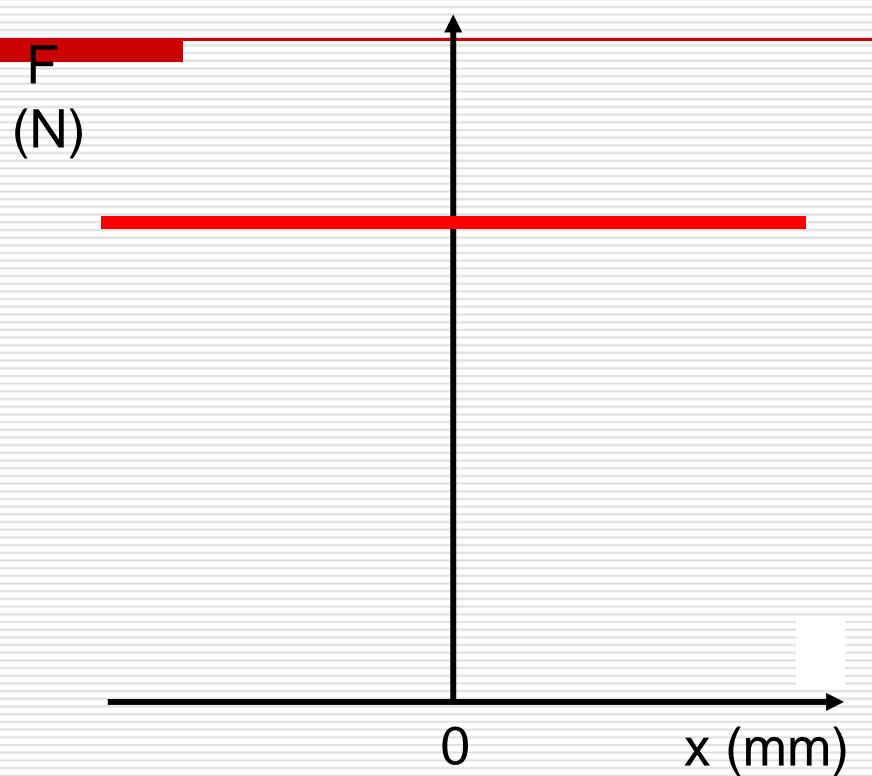


# DFplus<sup>®</sup>



**conventional solenoid**

force dependent of stroke



**VCD**

force independent of stroke

# DFplus® - Revolution in Dynamics & Force

## Assembly groups / Internal Features

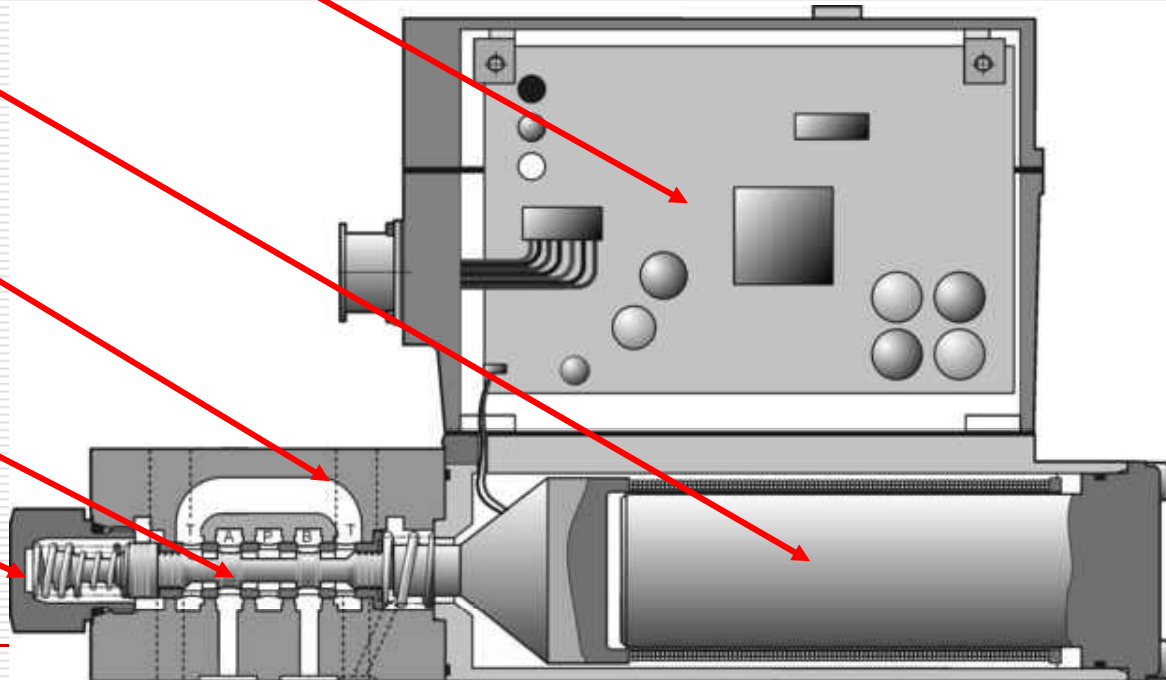
Integrated Drive Electronic

Voice Coil Drive

Valve Body

Spool-Sleeve  
Assembly

Spring Assembly  
f. Fail Save Position



# DFplus® - Revolution in Dynamics & Force

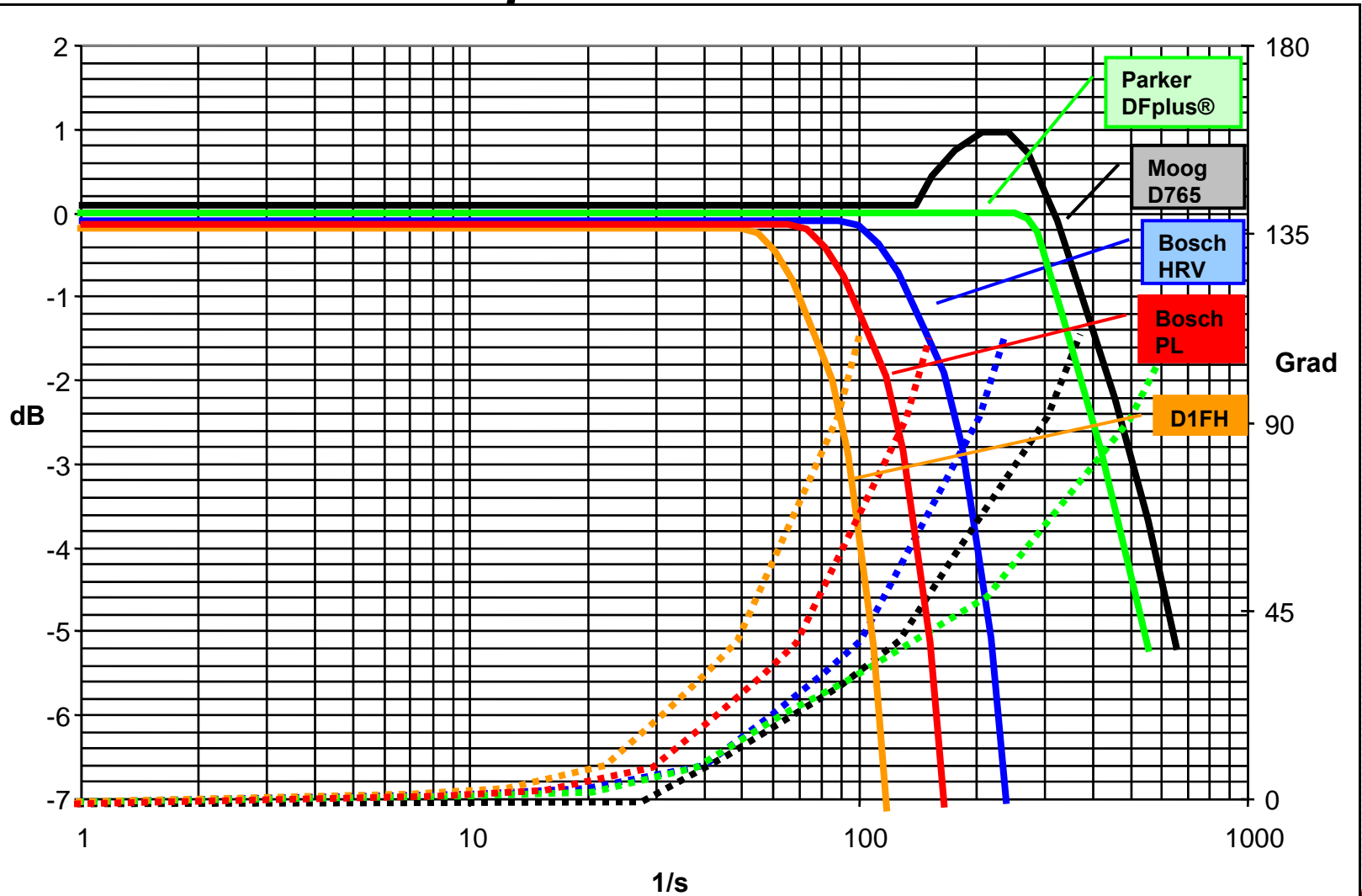
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- Parker DFplus®: Technical Data
  - Step Response < 3,5 ms
  - Dynamics
    - 3dB @ 350 Hz with 5%
    - 90° @ 340 Hz with 5%
  - Hysteresis < 0,05%
  - Resolution 1:4800 (2,4 mm/0,5 µm)
  - Nominal flow 3, 6, 12, 25, 40 [l/min] @ 35 bar  $\Delta p$  per edge
  - Leakage
    - < 0,4 l/min axis cut
    - < 0,05 l/min positive overlap
  - Flow rate 90 l/min @ 350 bar  $\Delta p$
  - Size NG6 (Cetop 3) + size 04
-



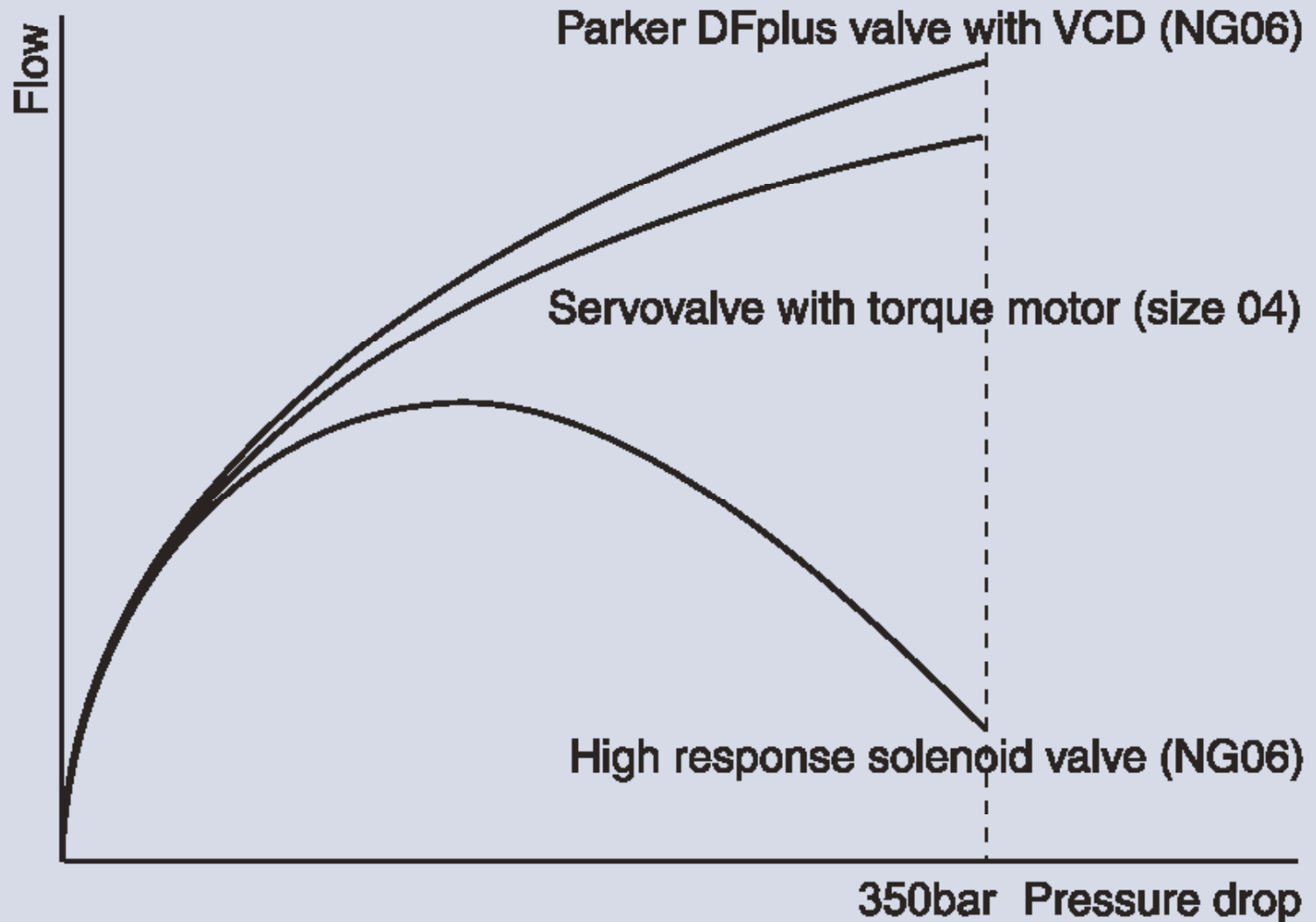
# Frequency response $\pm 5\%$

## Command signal\*



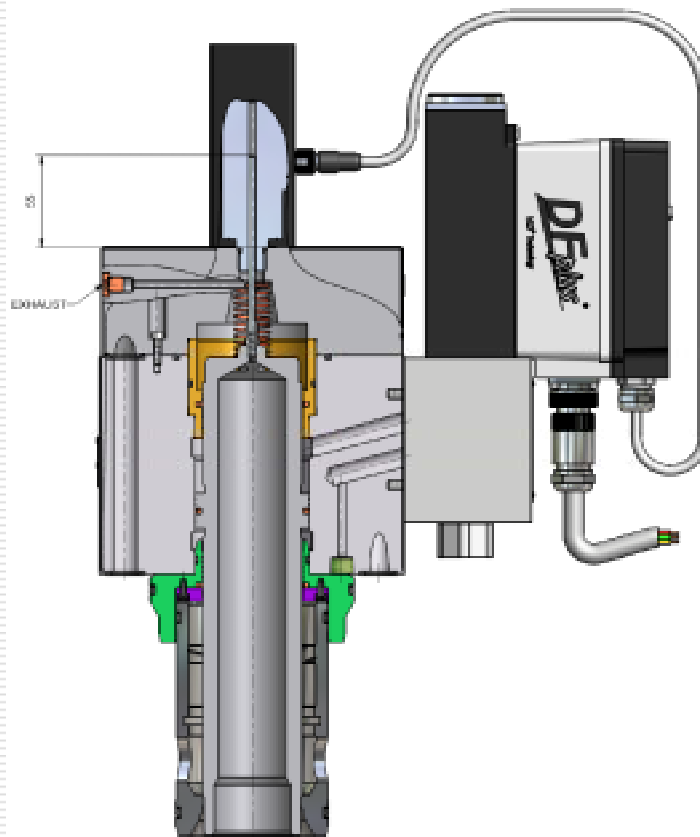
# Flow limit\*

\* schematics, all valves  $Q_{nom} = 40 \text{ l/min}$

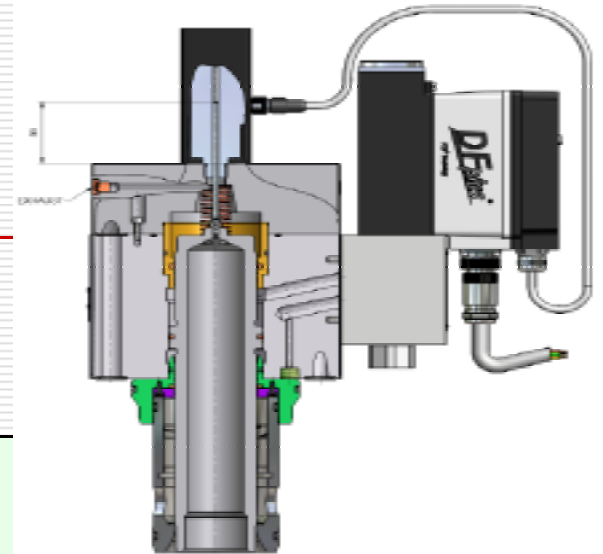


# DFplus® - Revolution in Dynamics & Force

## D1FP on TDP

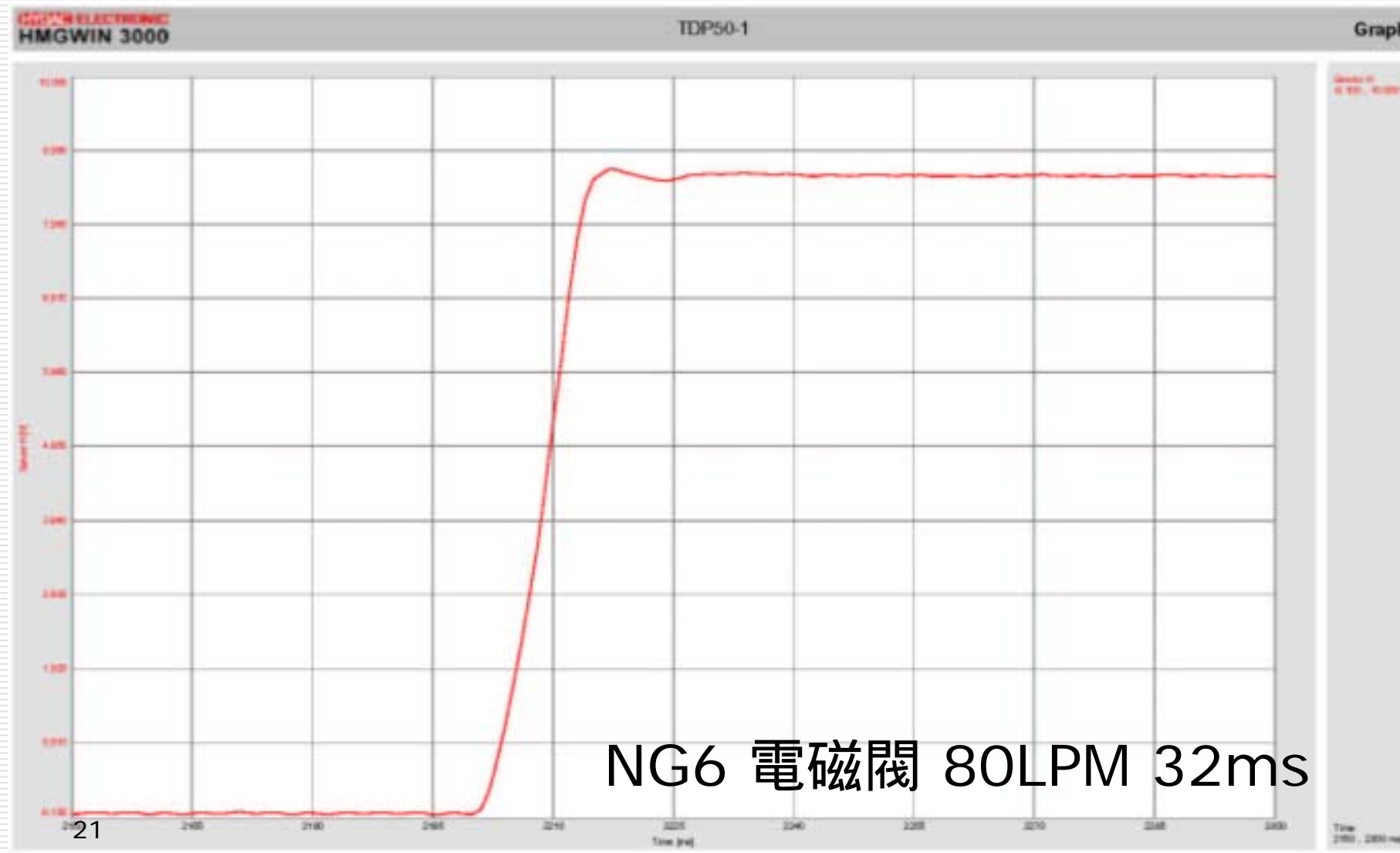


# Technical Data



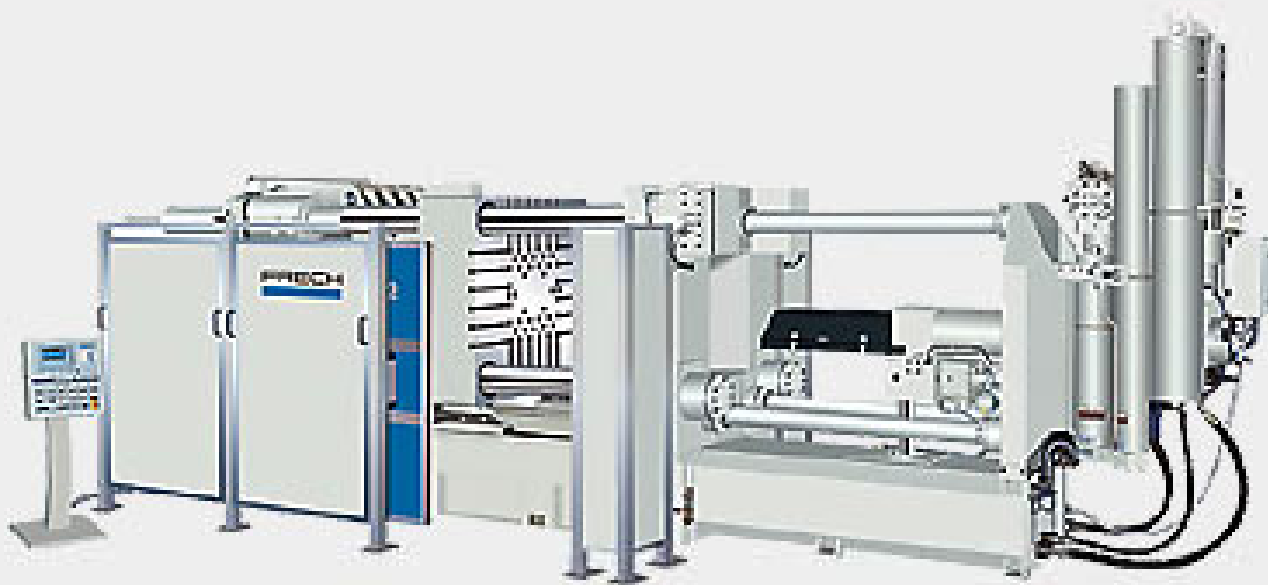
	TDP		
Size	Nominal flow @ 20bar $\Delta p$	Rec. max. flow	Step Resp.
NG 32	2500	6000	18
NG 40	3500	8000	18
NG 50	5400	12000	18
NG 63	7900	17500	15
NG 80	12200	27000	21
NG 100	19600	44000	28

NG50 0-100% 15ms 5400LPM



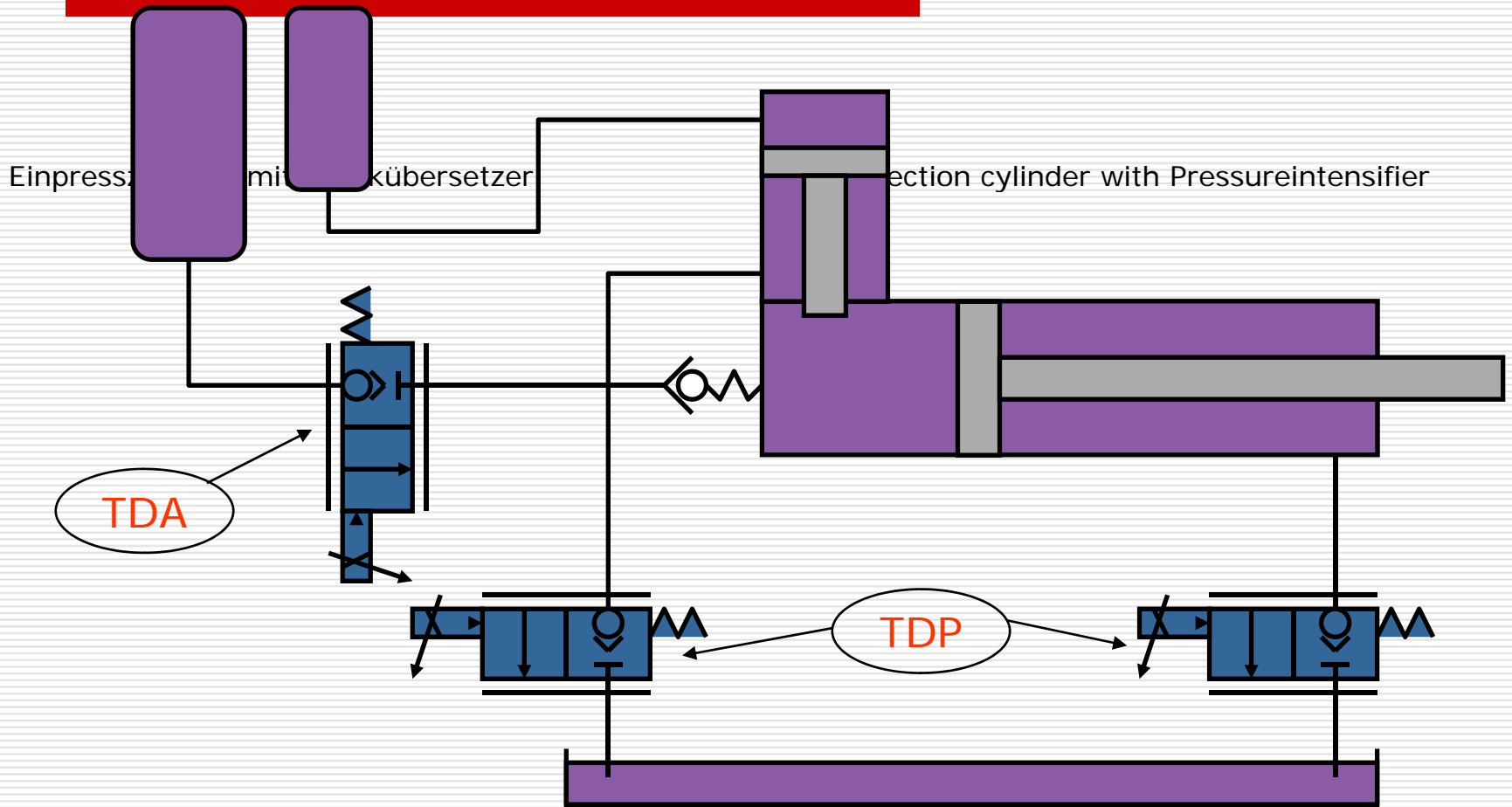
NG6 電磁閥 80LPM 32ms

# 壓鑄機

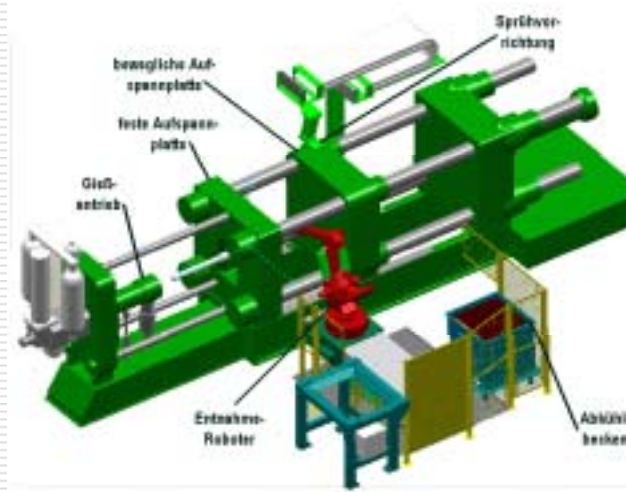
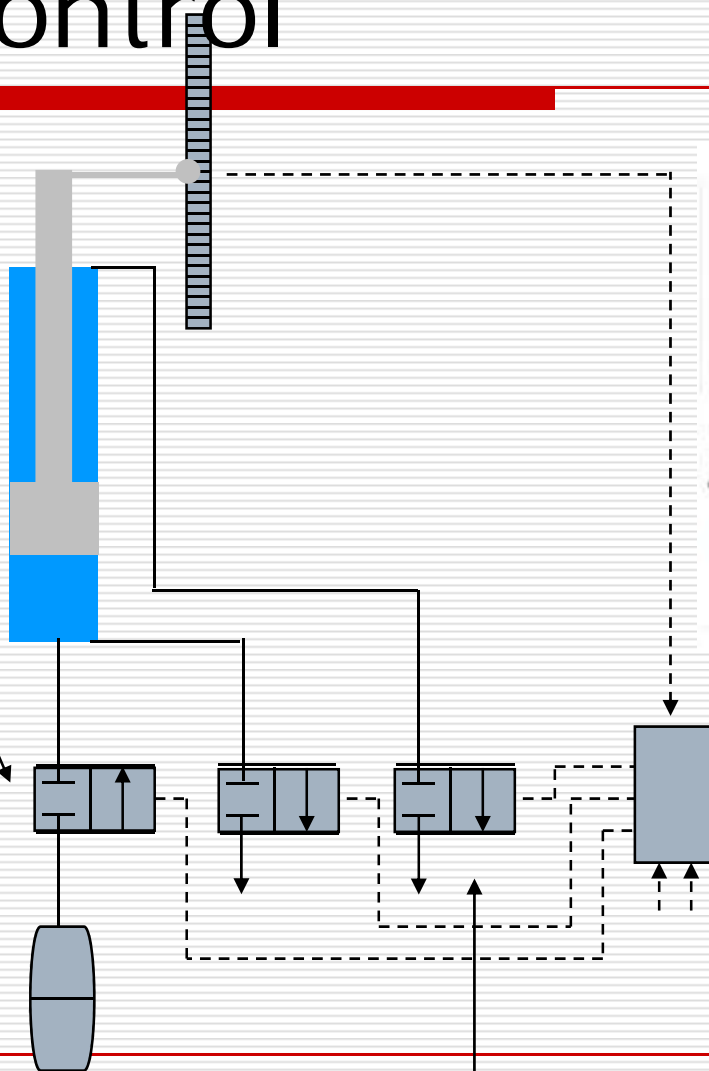
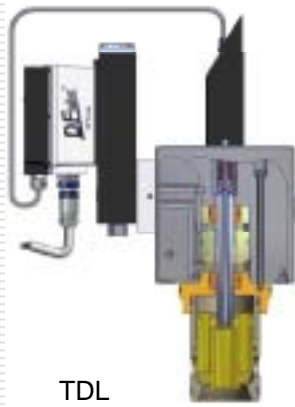


# Application:

## Die Casting Machine



# Brake Control





# Typical Applications

Primary

Wind

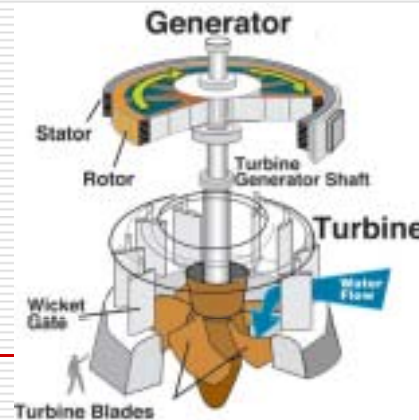
Injection

Molding



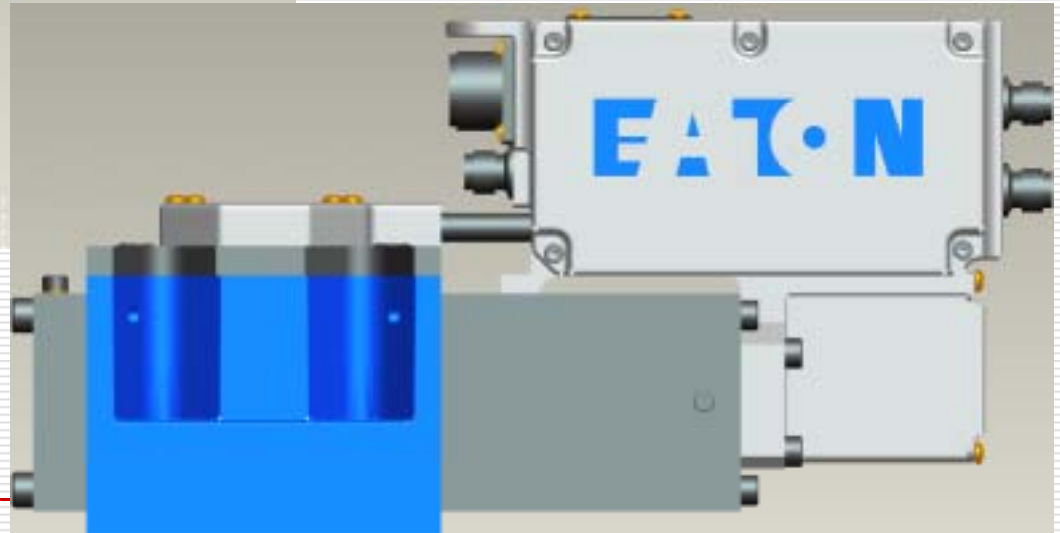
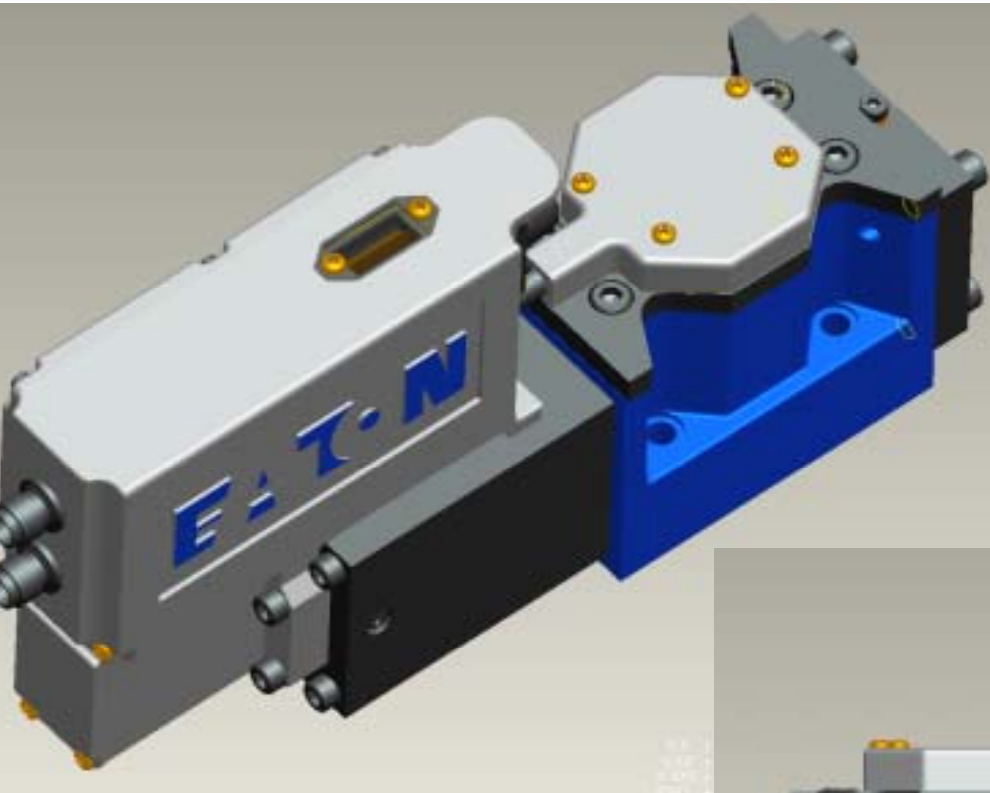
Presse

Turbine



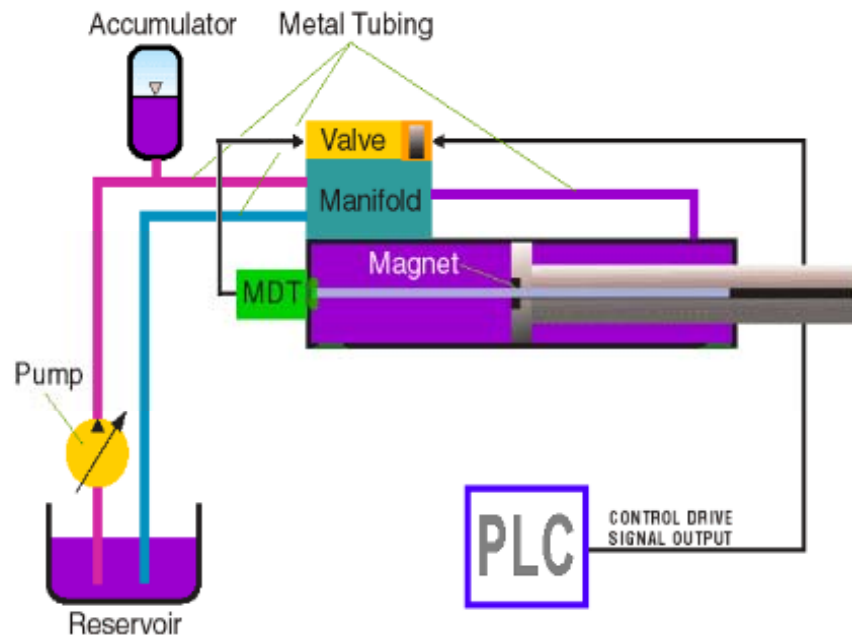
# New Generation Prop Valve

- ISO 05



# New Generation Prop Valve - Features

Electronics & Control								
Communication		Embedded Intelligence					Prognostics & Diagnostics	
Configurability	Connectivity BUS	Built-in Sensor	Axis Control	PQ	Synch	Other Features	Valve Monitor	LED
●	●	●	●	●	●	Customer IP on valve; Temp sensor for OBE	●	●



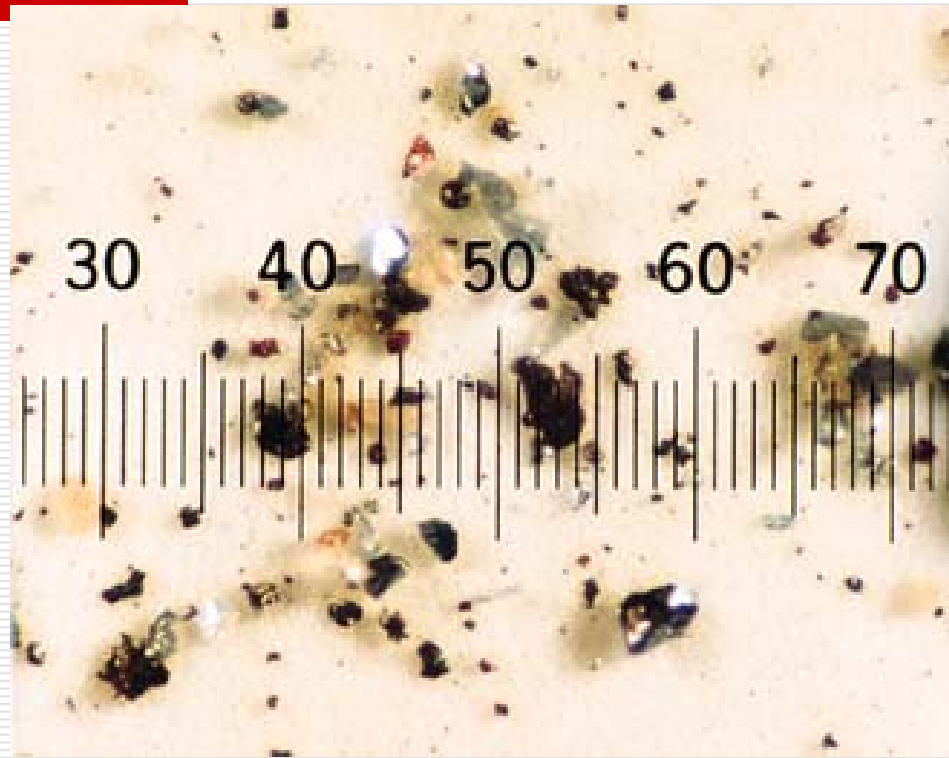
# Filter 過濾

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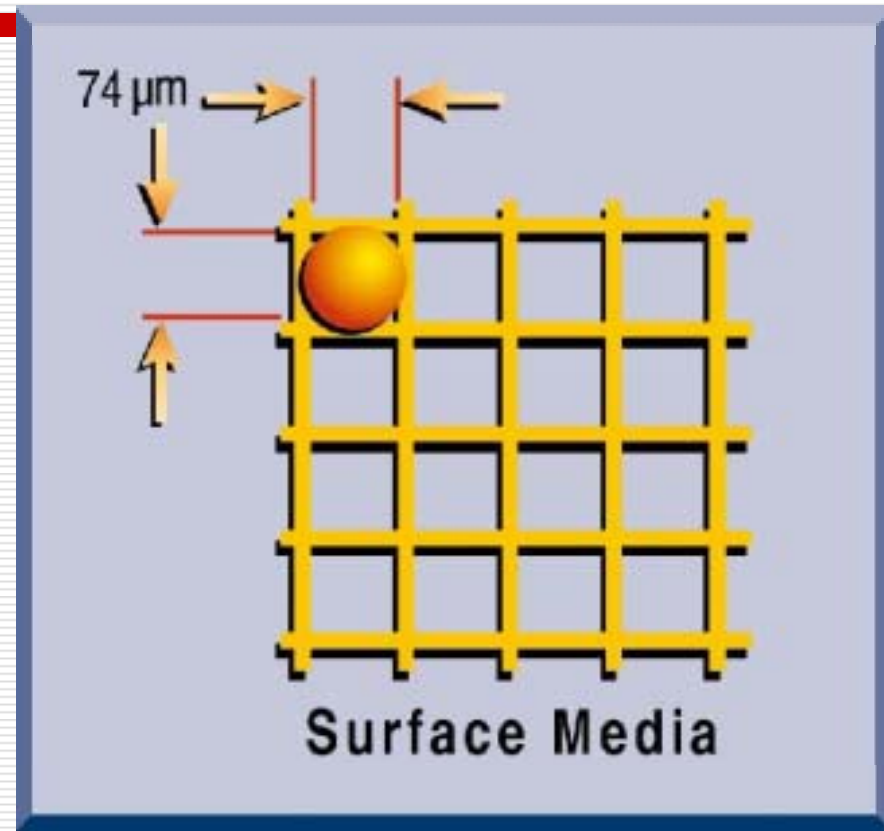
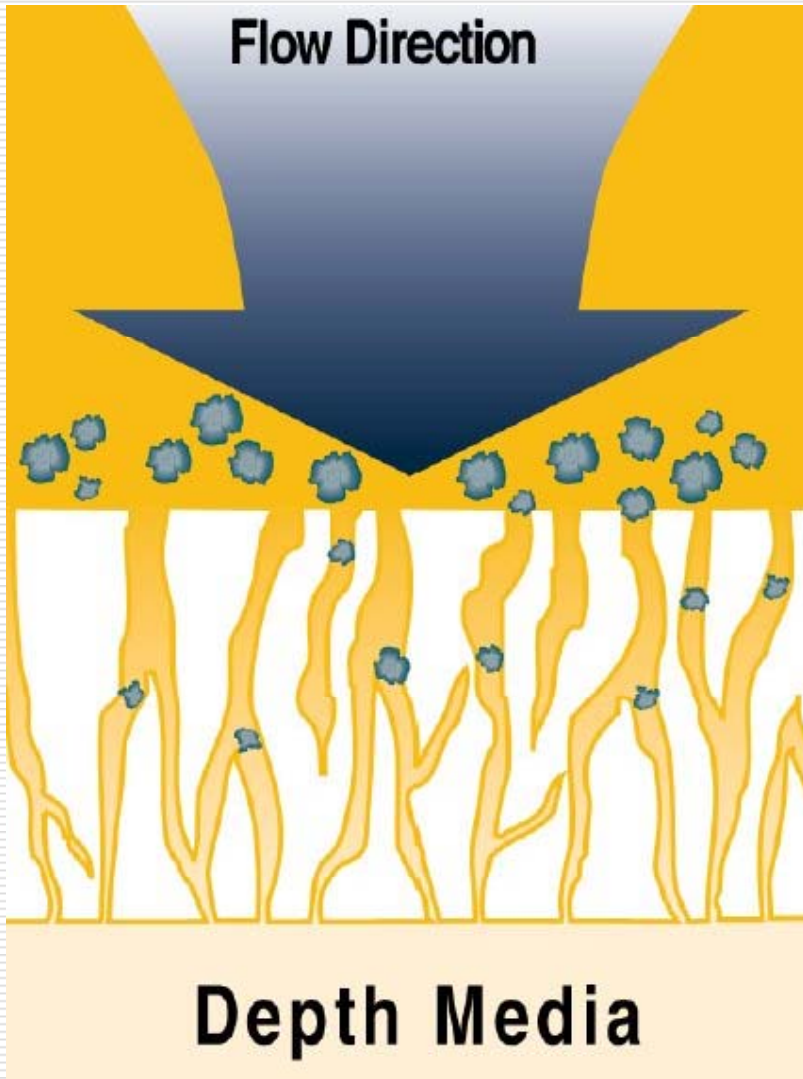
- 雜質
- 水份
- 酸價

# 80% System Failure! 系統失效

- 80% of hydraulic system failures are due to excessive contamination.

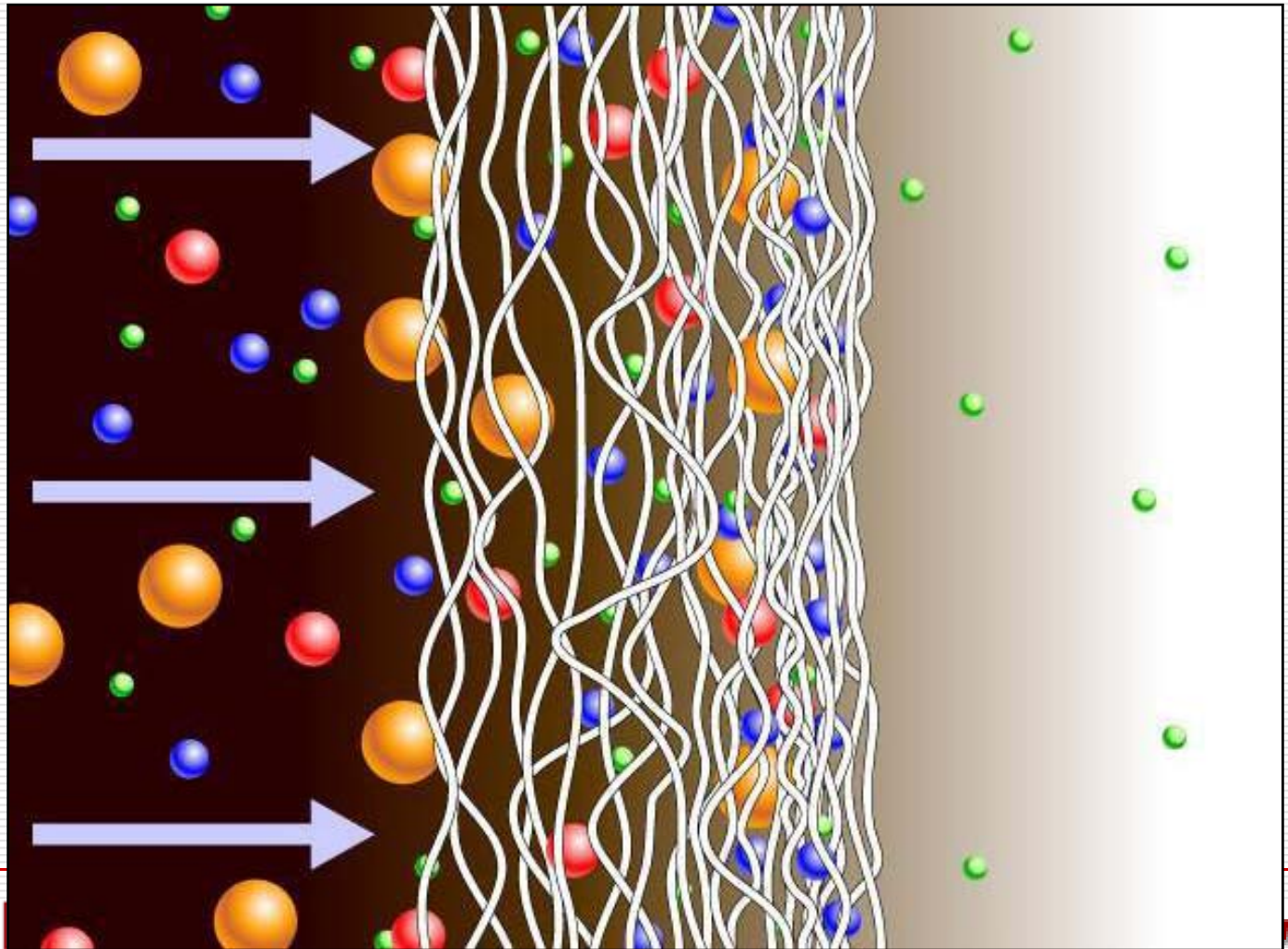


◆ 100倍 1div=20um

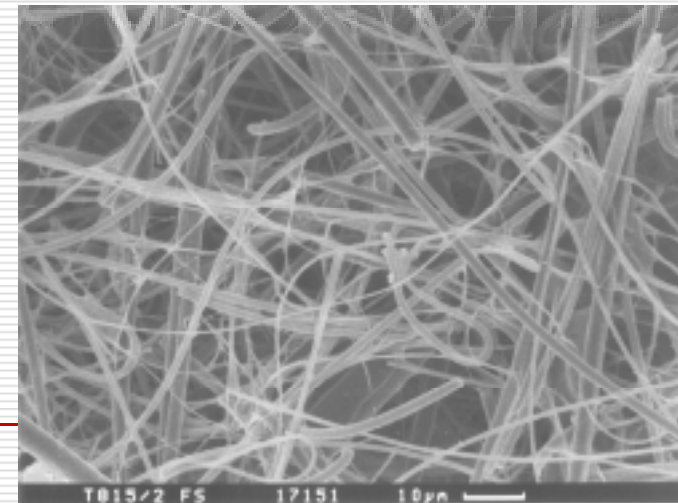
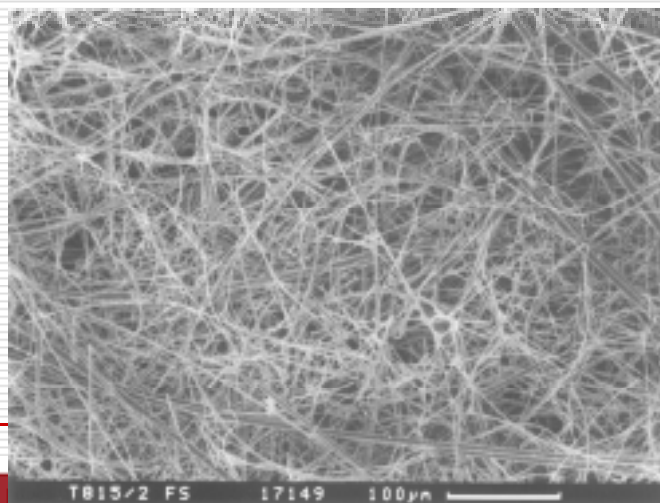
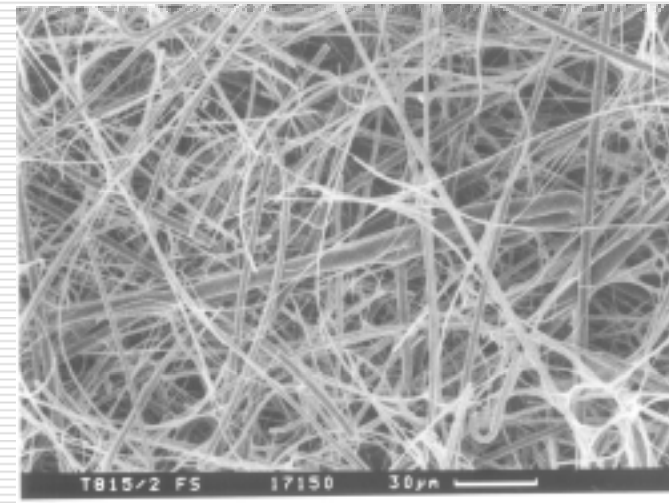
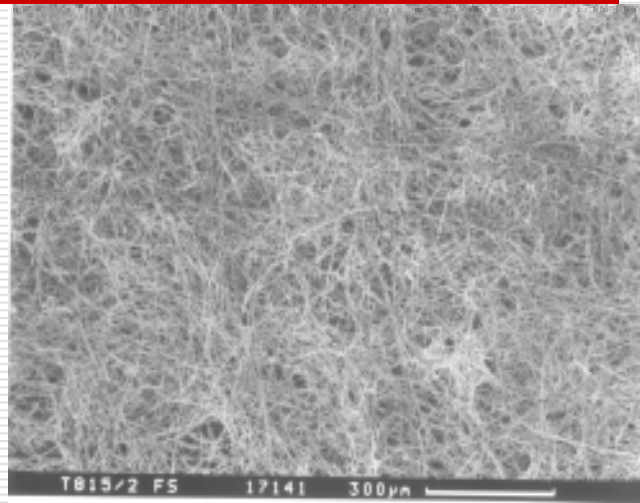


# Filter Element Material Features of Depth Filters

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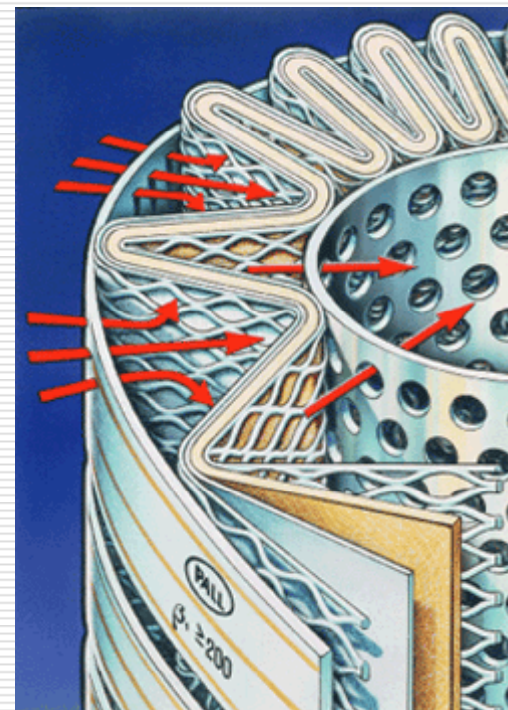
# Depth Filters under the Electron Microscope





# Filter 機械過濾

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ISO 21/19/16  
100x  
NAS 10 級

新油  
ISO 20/18/15  
NAS 9級

ISO 16/14/11  
100x  
NAS 5 級

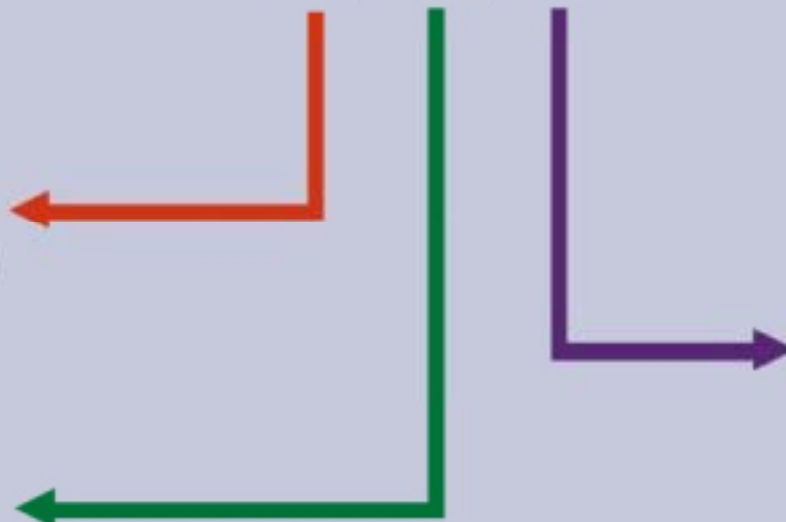
# ISO CODE

**18 / 16 / 13**

**Particles  
≥ 2 microns**

**Particles  
≥ 5 microns**

**Particles  
≥ 15 microns**

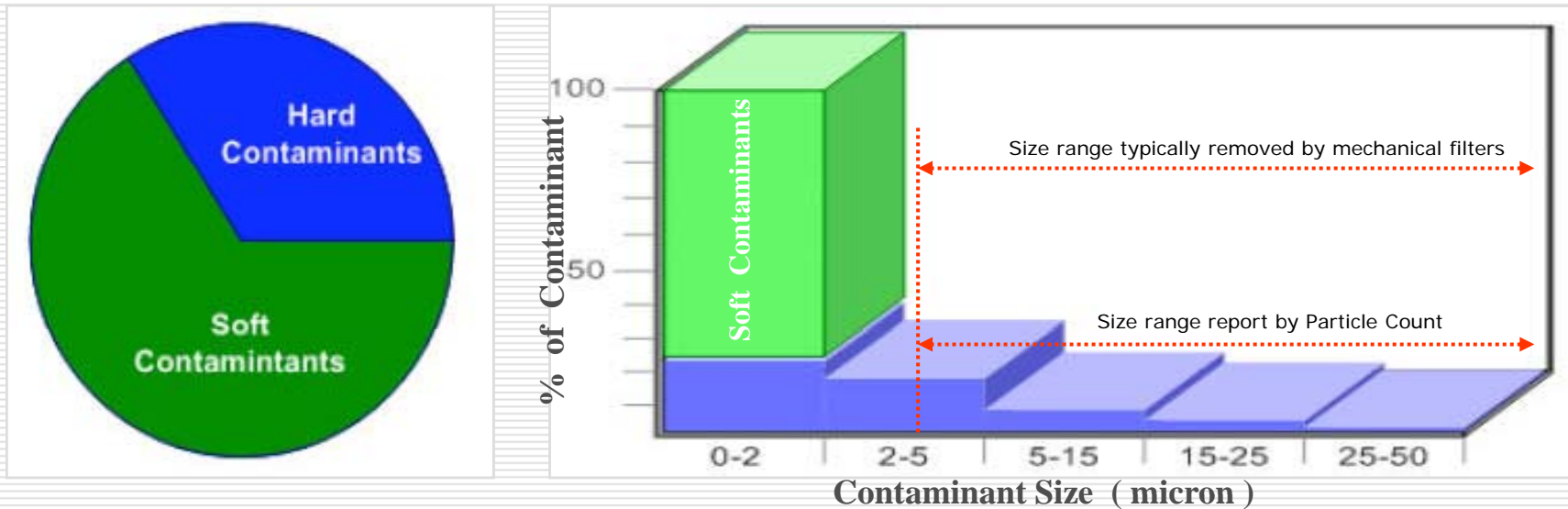


## Cleanliness Level Correlation Table

ISO Code	Particles/Millilitre			NAS 1638 (1964)	Disavowed SAE Level (1963)
	≥2 Micrometers	≥5 Micrometers	≥15 Micrometers		
23/21/18	80,000	20,000	2,500	12	–
22/20/18	40,000	10,000	2,500	–	–
22/20/17	40,000	10,000	1,300	11	–
22/20/16	40,000	10,000	640	–	–
21/19/16	20,000	5,000	640	10	–
20/18/15	10,000	2,500	320	9	6
19/17/14	5,000	1,300	160	8	5
18/16/13	2,500	640	80	7	4
17/15/12	1,300	320	40	6	3
16/14/12	640	160	40	–	–
16/14/11	640	160	20	5	2
15/13/10	320	80	10	4	1
14/12/9	160	40	5	3	0
13/11/8	80	20	2.5	2	–
12/10/8	40	10	2.5	–	–
12/10/7	40	10	1.3	1	–
12/10/6	40	10	.64	–	–

# Total Contamination in Turbine Oils

## The Ratio of Soft Contaminants and Hard Contaminants



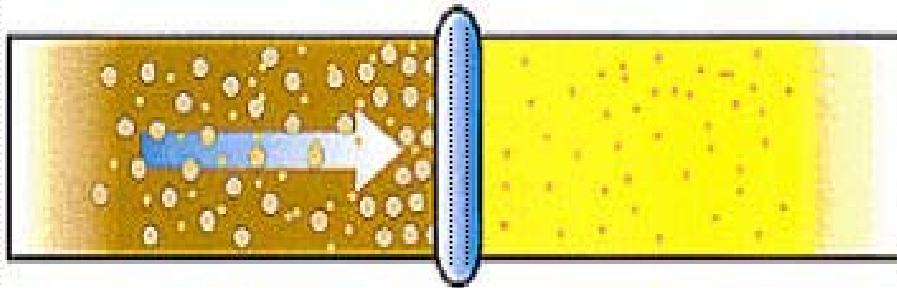
**Hard Particles** : wear metals debris  
dust ,fibers ,etc

**Soft Particles** : degradation by-  
products (oxidation ,  
thermal and  
depleted additives )

**Soft Contaminants** are typically  
less than 1 micron in size – too small  
to be removed with traditional filter

# Mechanical Filtration- Not The Solution

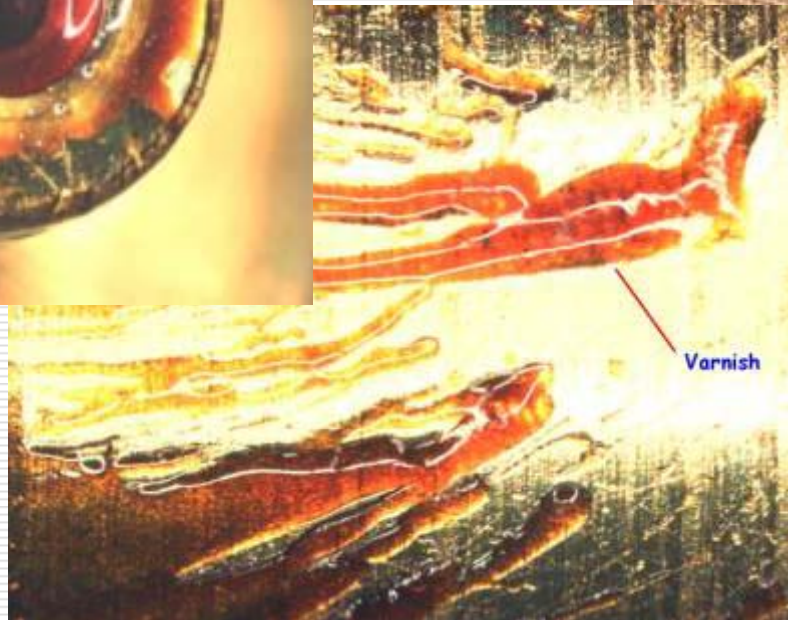
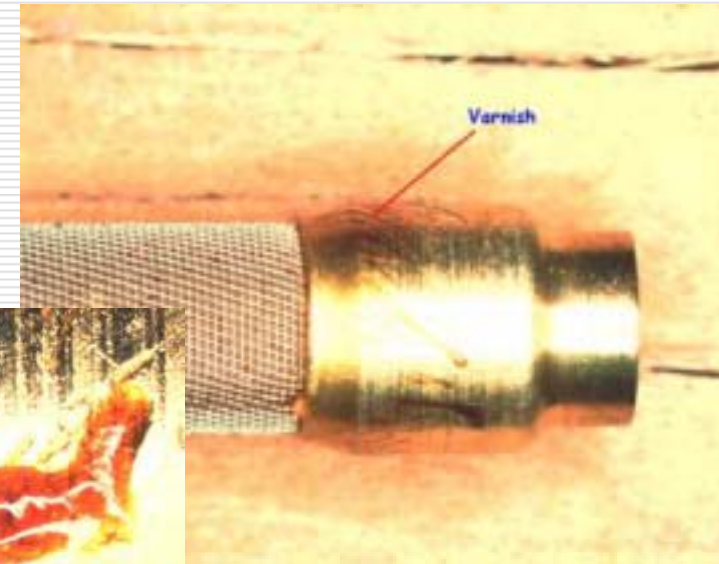
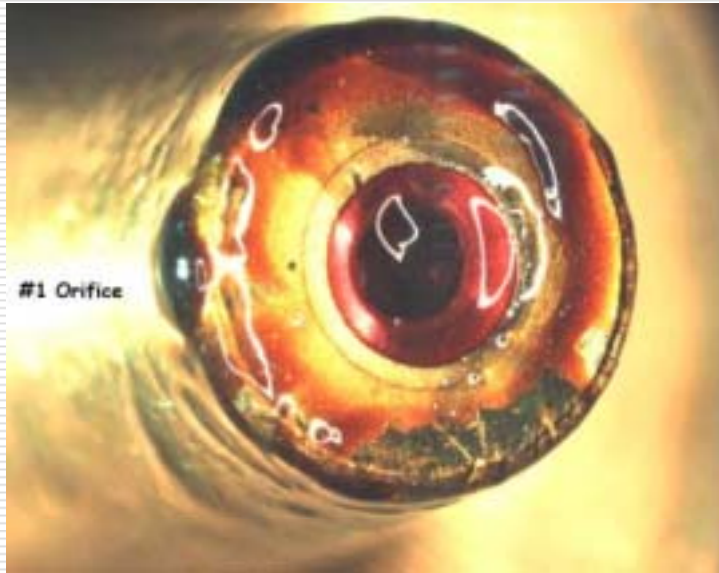
## ระบบกรองทั่วไป - ไม่ใช่วิธีแก้ไขการกำจัดวานิช



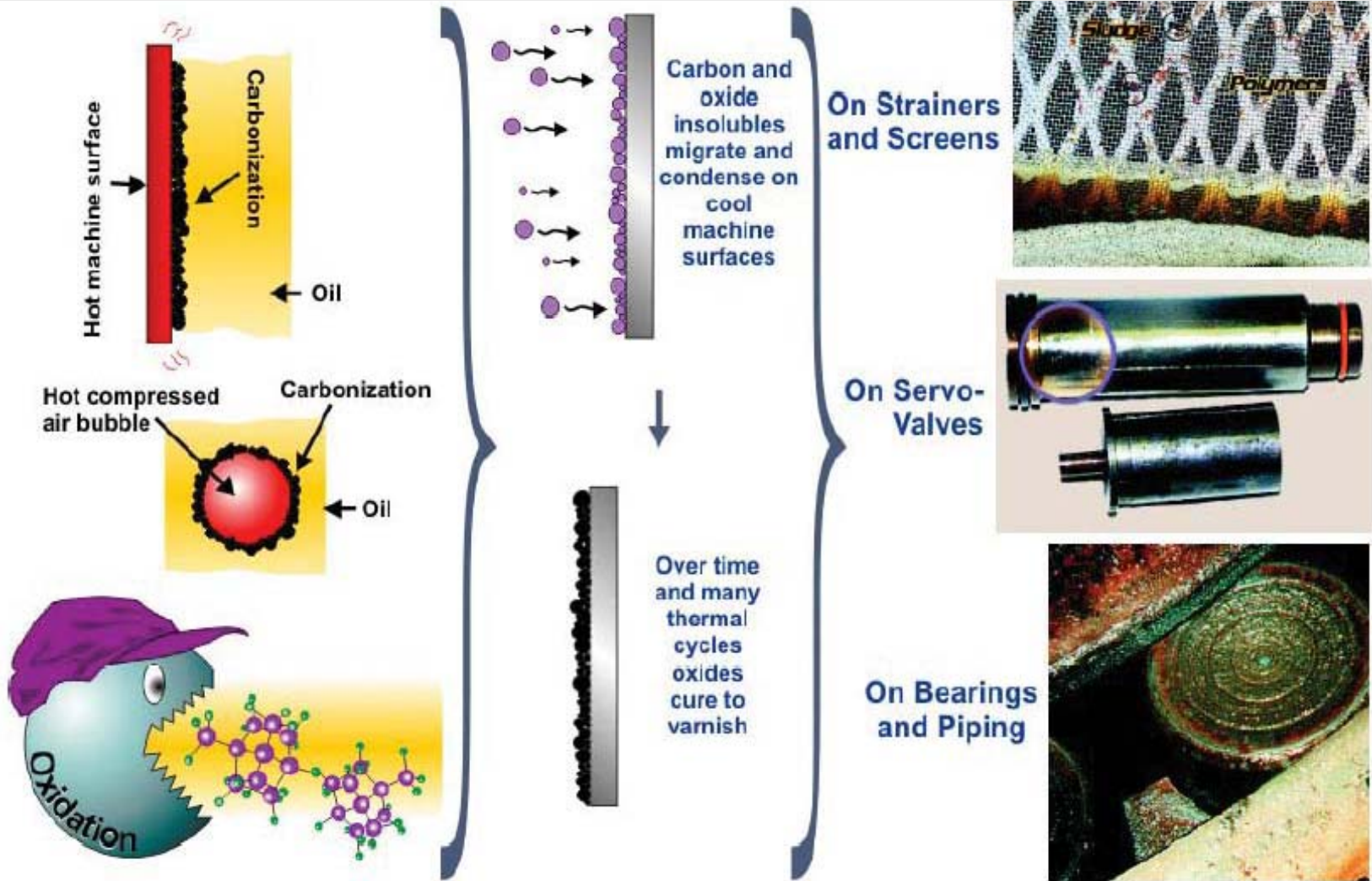
- ❑ Ineffective for small particles- mostly remove  $> 3$  micron
- ❑ Ineffective for soft particles and precursors of varnish
- ❑ Do not remove varnish,  
with high efficiency filter and excessive pressure ,  
actually creates more varnish.

# Varnish

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# Varnish Formation

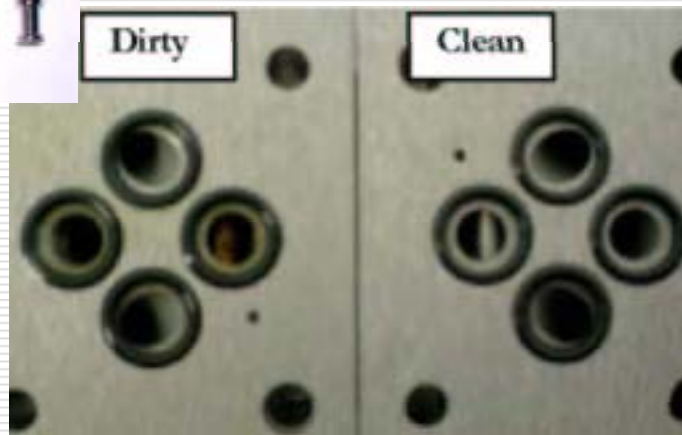
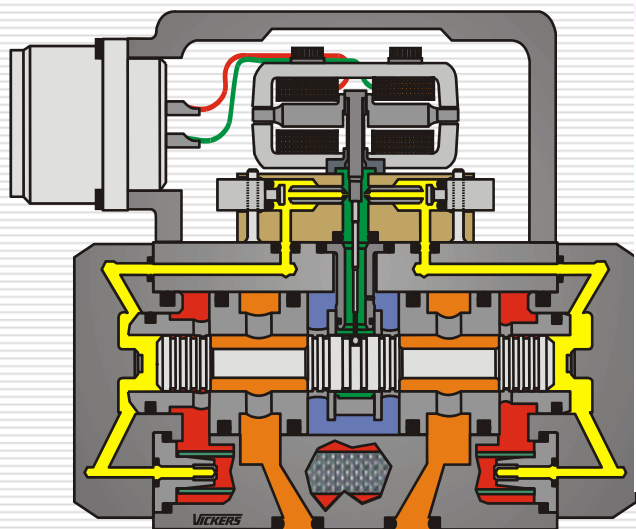


Ref: JCF



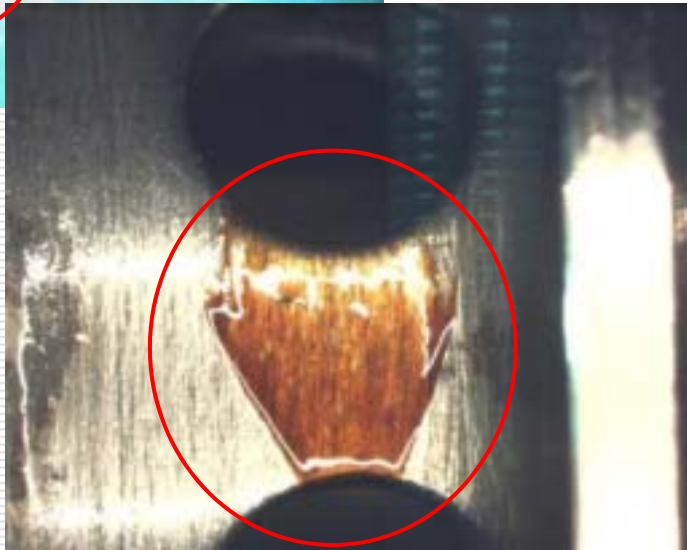
# Servo Pencil Filter

伺服閥 濾心



# Varnish effect on slide spool.

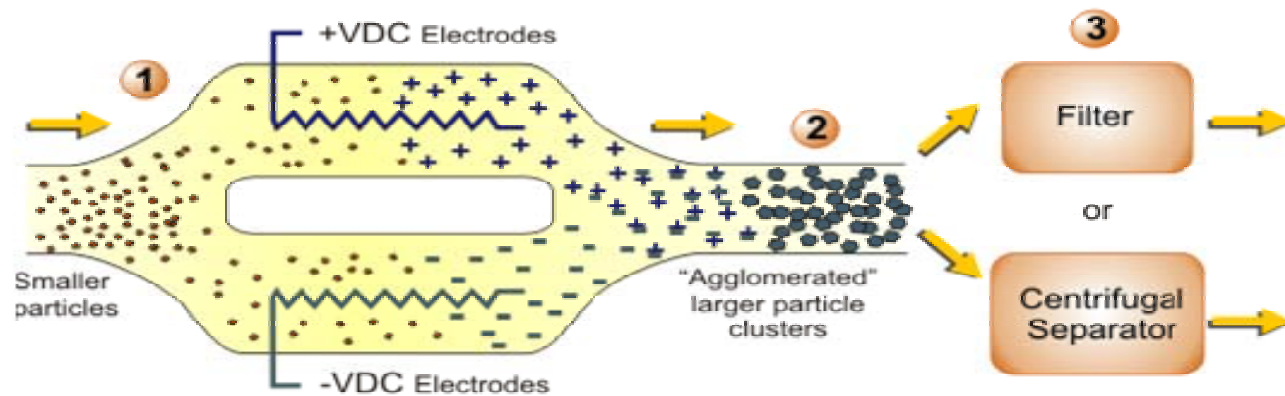
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- Varnish interferes with the operation of the slide spool, or plugs one of the orifices.
  - Spool acts sluggishly or not at all, or
  - Pressure/flow discrepancy that forces the spool to an undesired position.
- If the component stays “out of position” for a predetermined time, turbine trip results.

# How the technology works:

## "Balanced Charge Agglomeration™" (BCA)

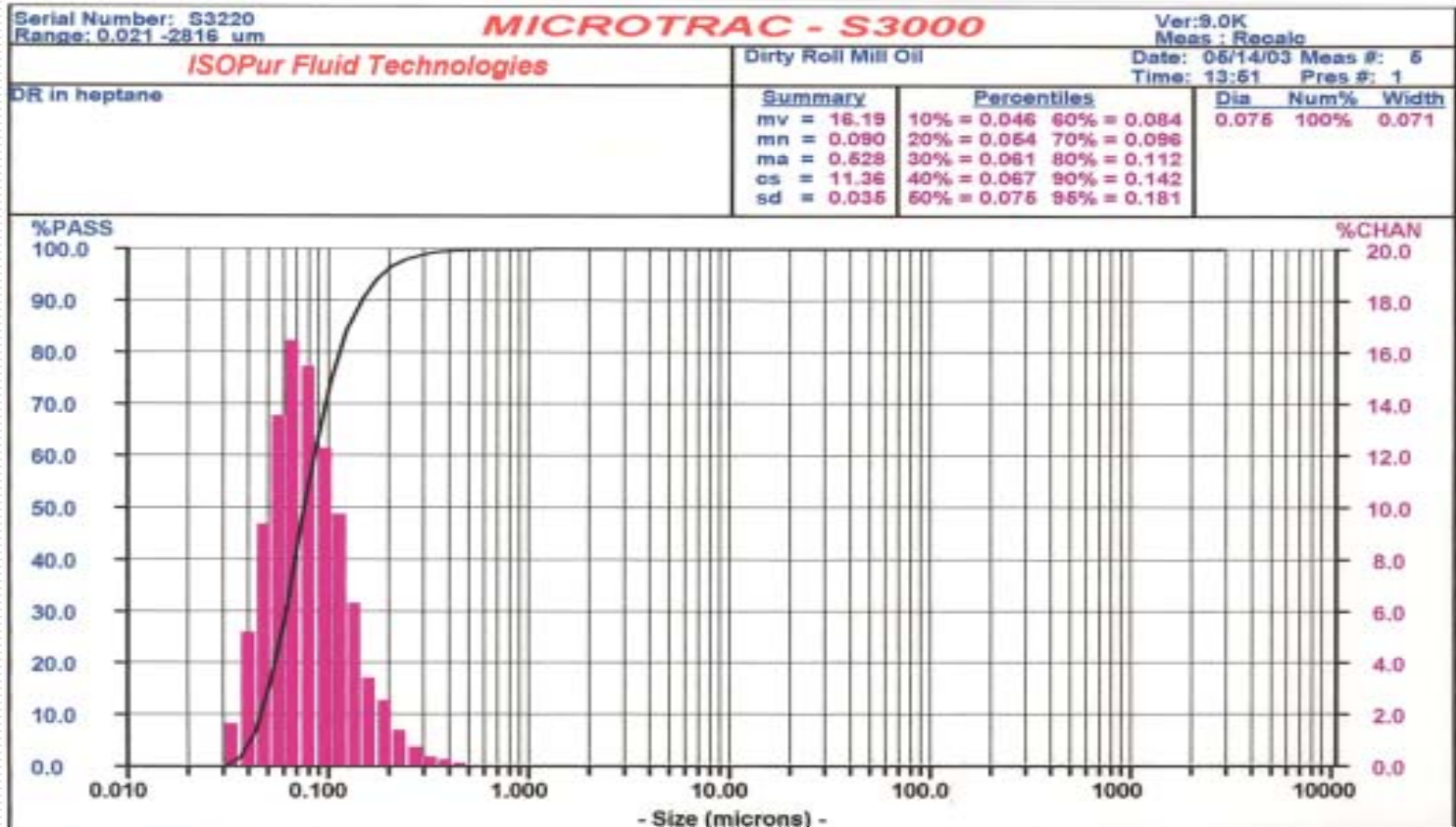


- 1** Particles are passed across high-voltage electrodes, inducing a charge on the particles (+) and (-) in separate paths.
- 2** Oppositely charged particles are mixed and are attracted to each other, forming larger particle clusters.
- 3** Particle clusters are more efficiently filtered or removed by centrifugal separators.

# Roll Mill Oil

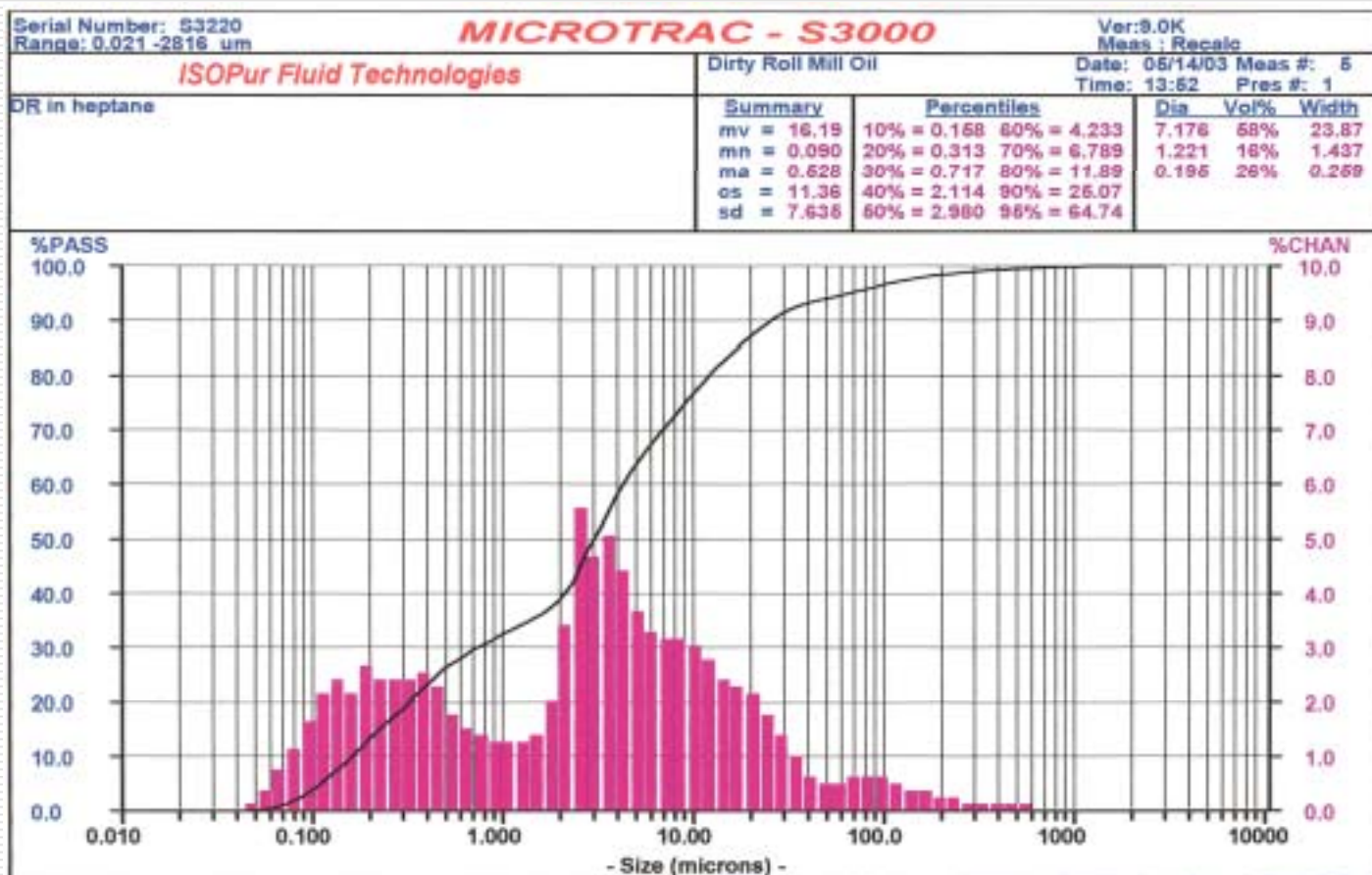
## 顆粒分析

2003.5.14.13:51



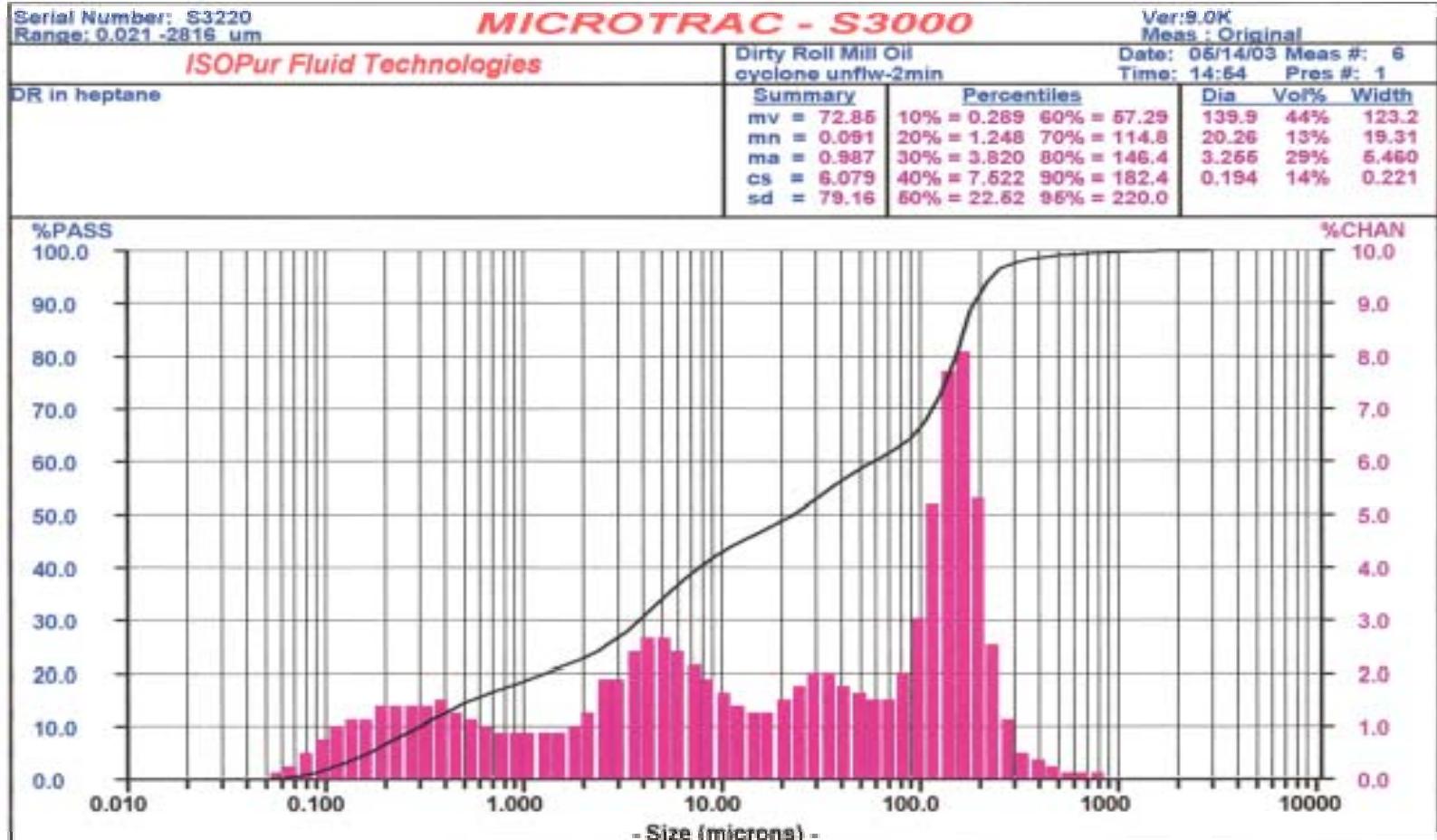
# 顆粒分析

# 2003.5.14.13:52



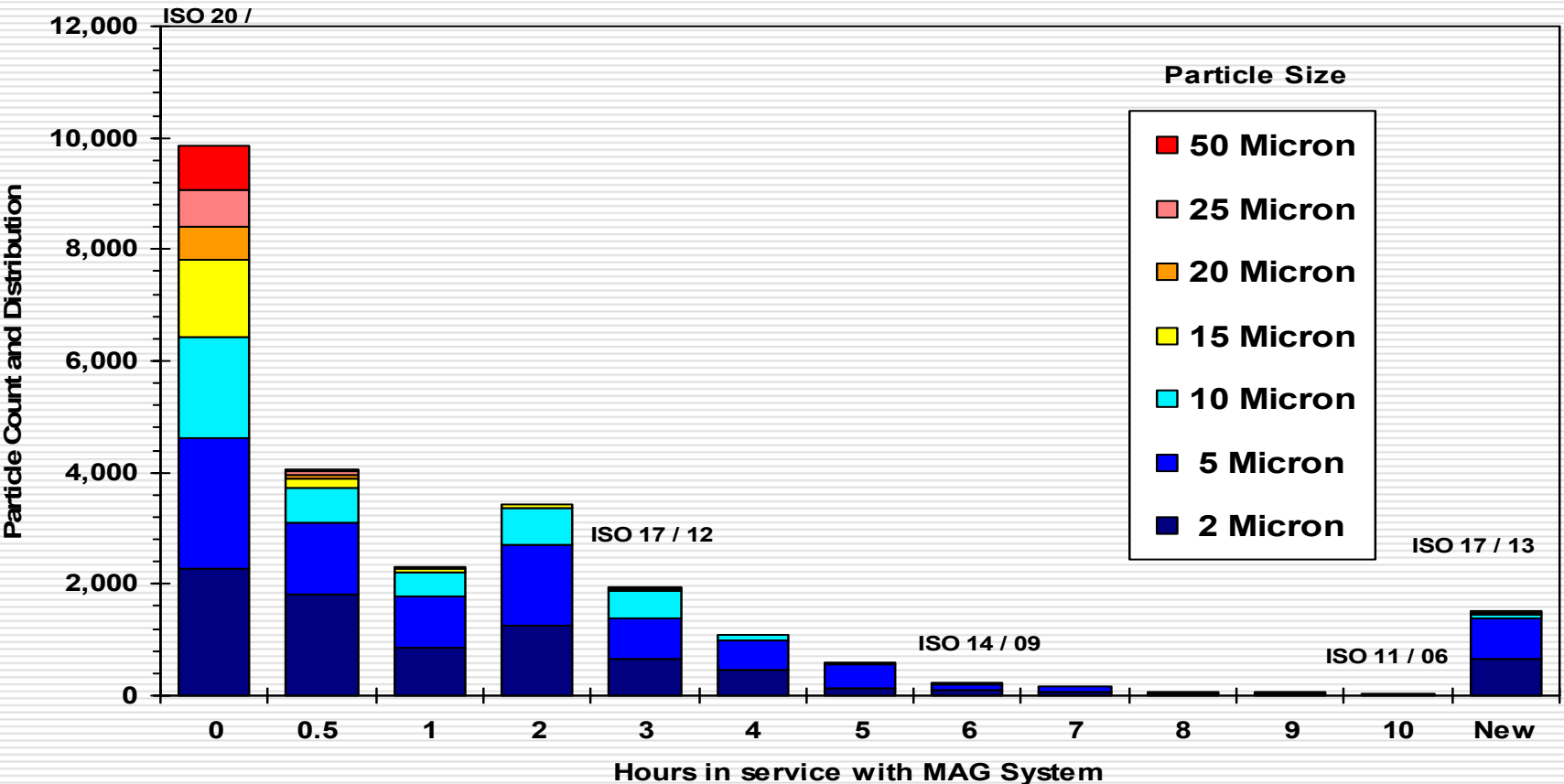
# 顆粒分析

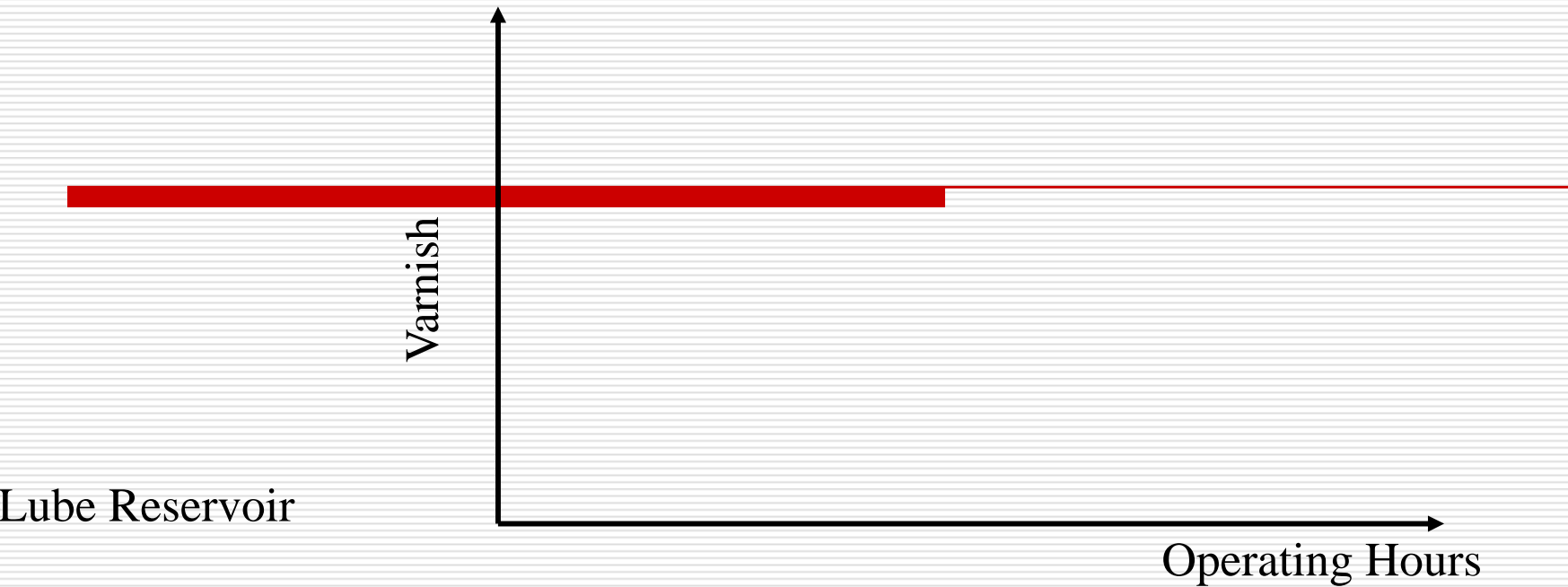
# 2003.5.14.15:54



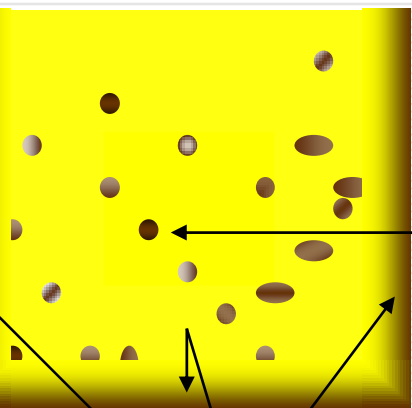
# Hydraulic Oil—early test to remove submicron particles.

Hydraulic Oil Purification





Lube Reservoir

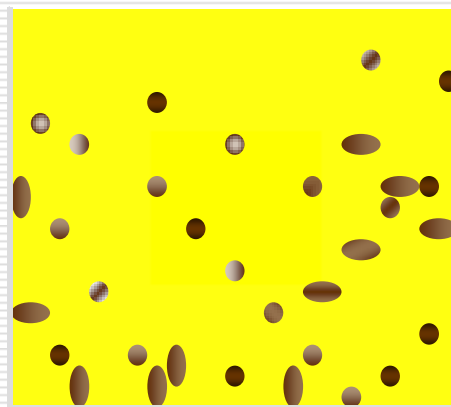
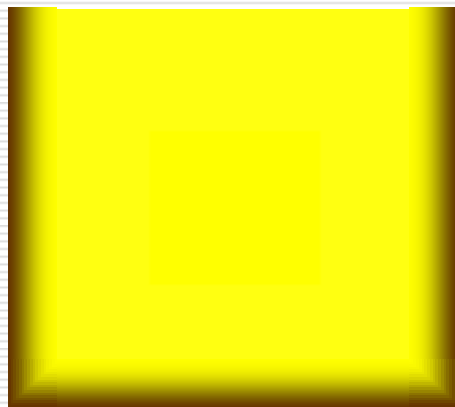
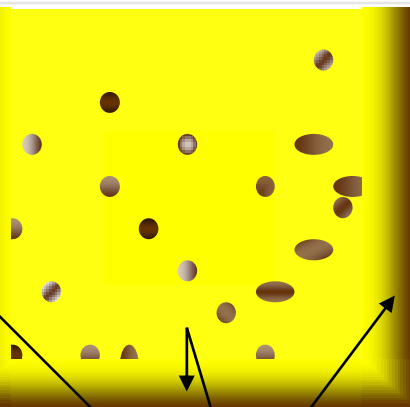
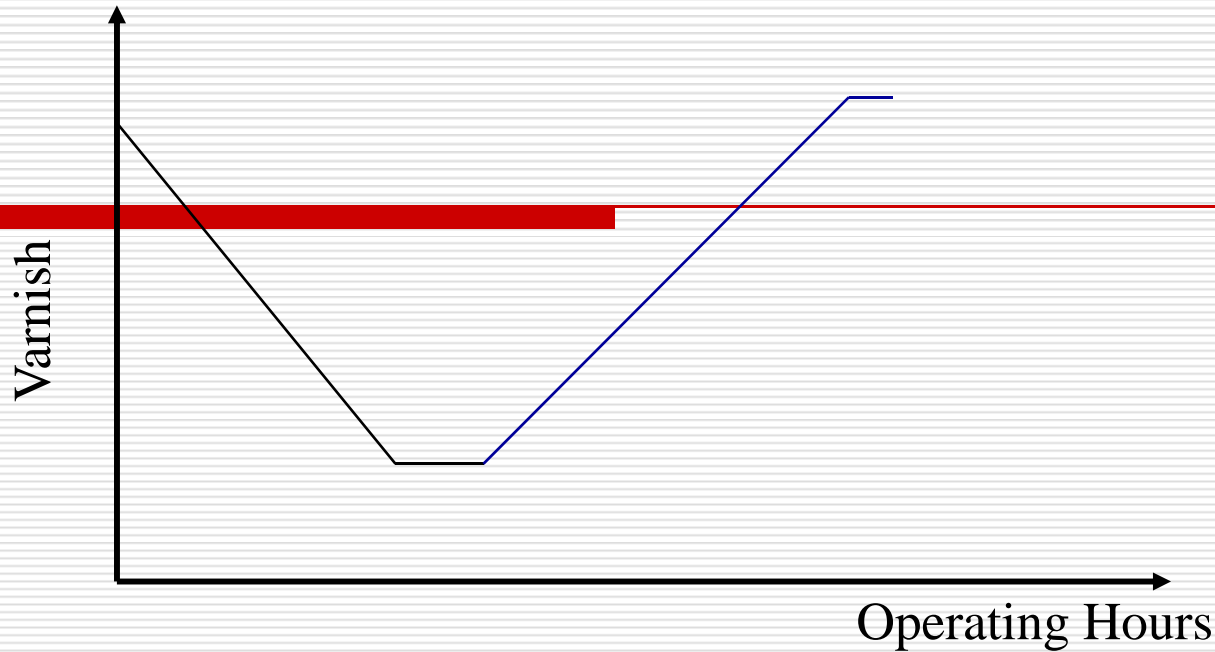
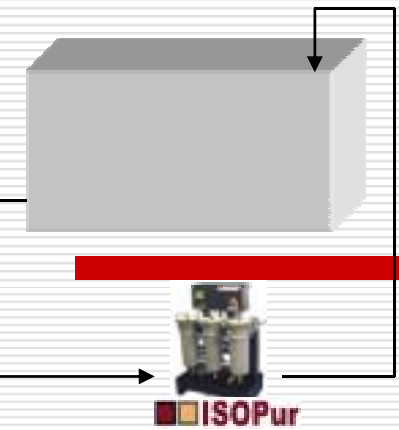


varnish

Varnish layers  
 ISOPur™

***The Power of Purity***

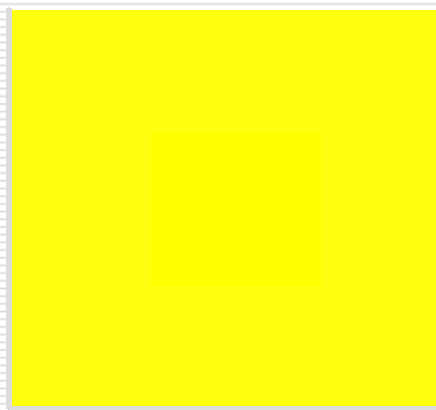
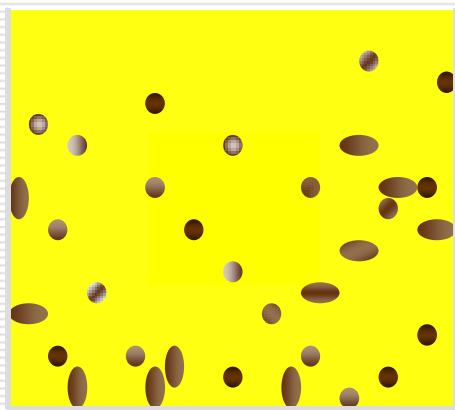
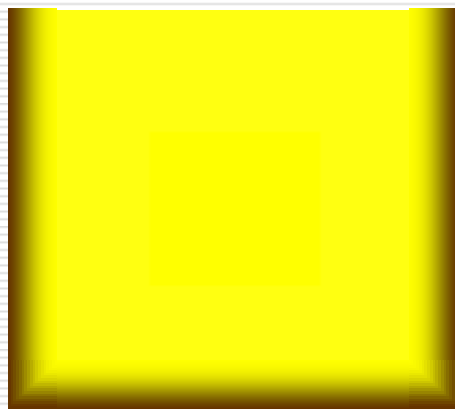
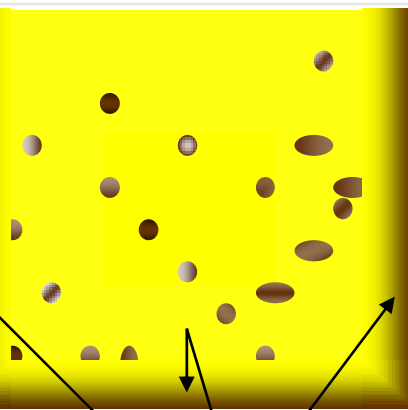
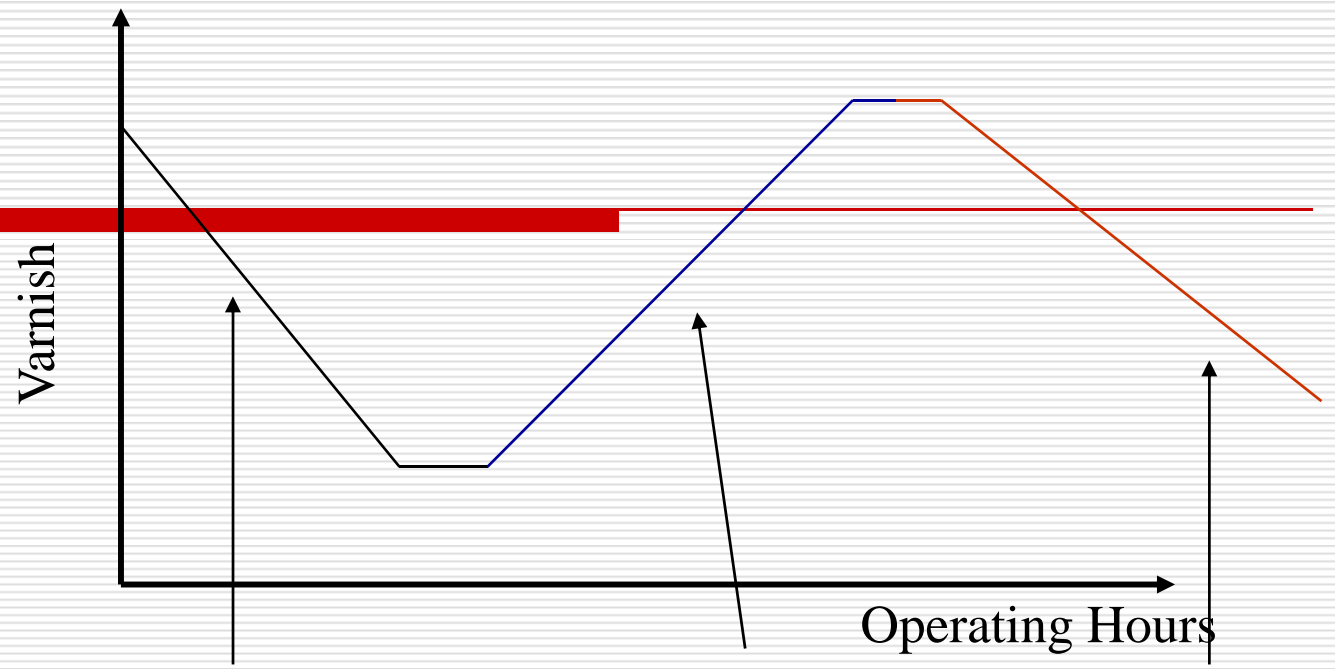
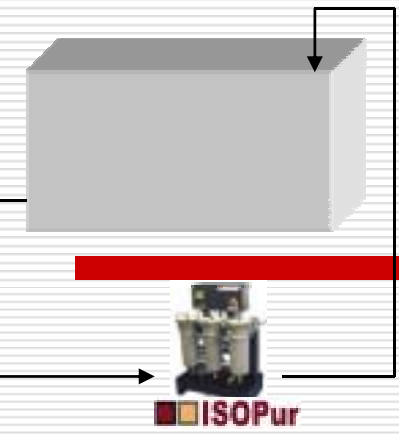




Varnish layers  
 ISOPur™

2<sup>nd</sup> phase upward trend  
 Varnish had been plated out and reabsorbed into turbine oil

*The Power of Purity*



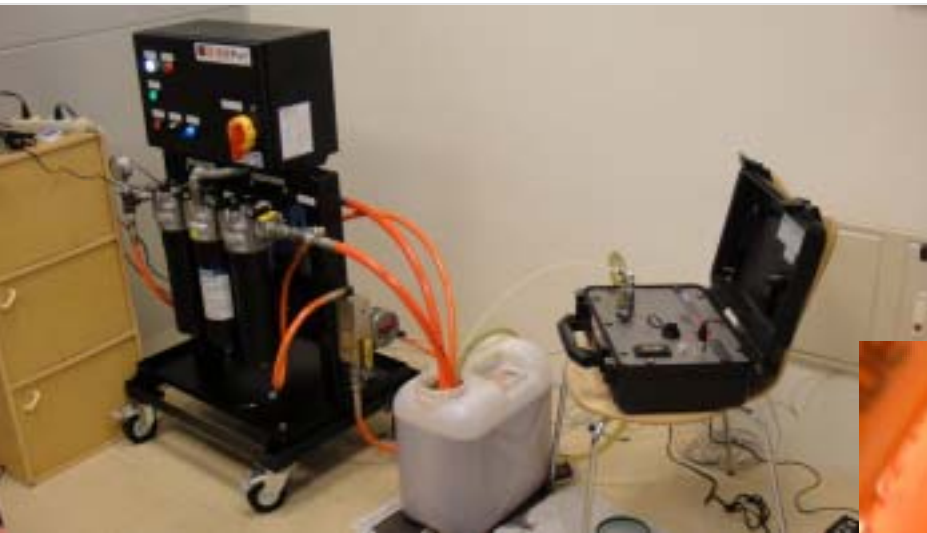
Varnish layers  
 ISOPur™

3rd phase , downward trend  
 ISOPur had cleaned up varnish. Varnish level drop down  
 System surface and turbine become clean again.  
**The Power of Purity**

# Machinery Cleaning

## NAS 10/9/7 0級

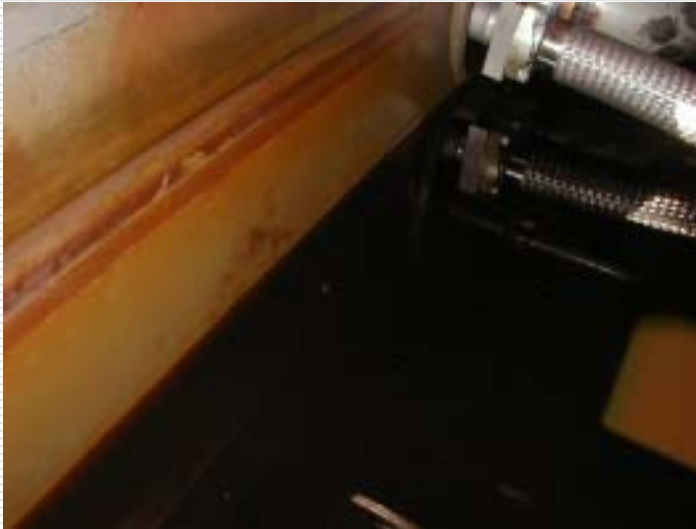
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# Reservoirs

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- ❑ Varnish buildup on reservoir walls.
- ❑ Return line from ISOPur system shows varnish removed.



# Reservoirs after ISOPur System Treatment

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# Oil Reservoir after ISOPur system cleaning.

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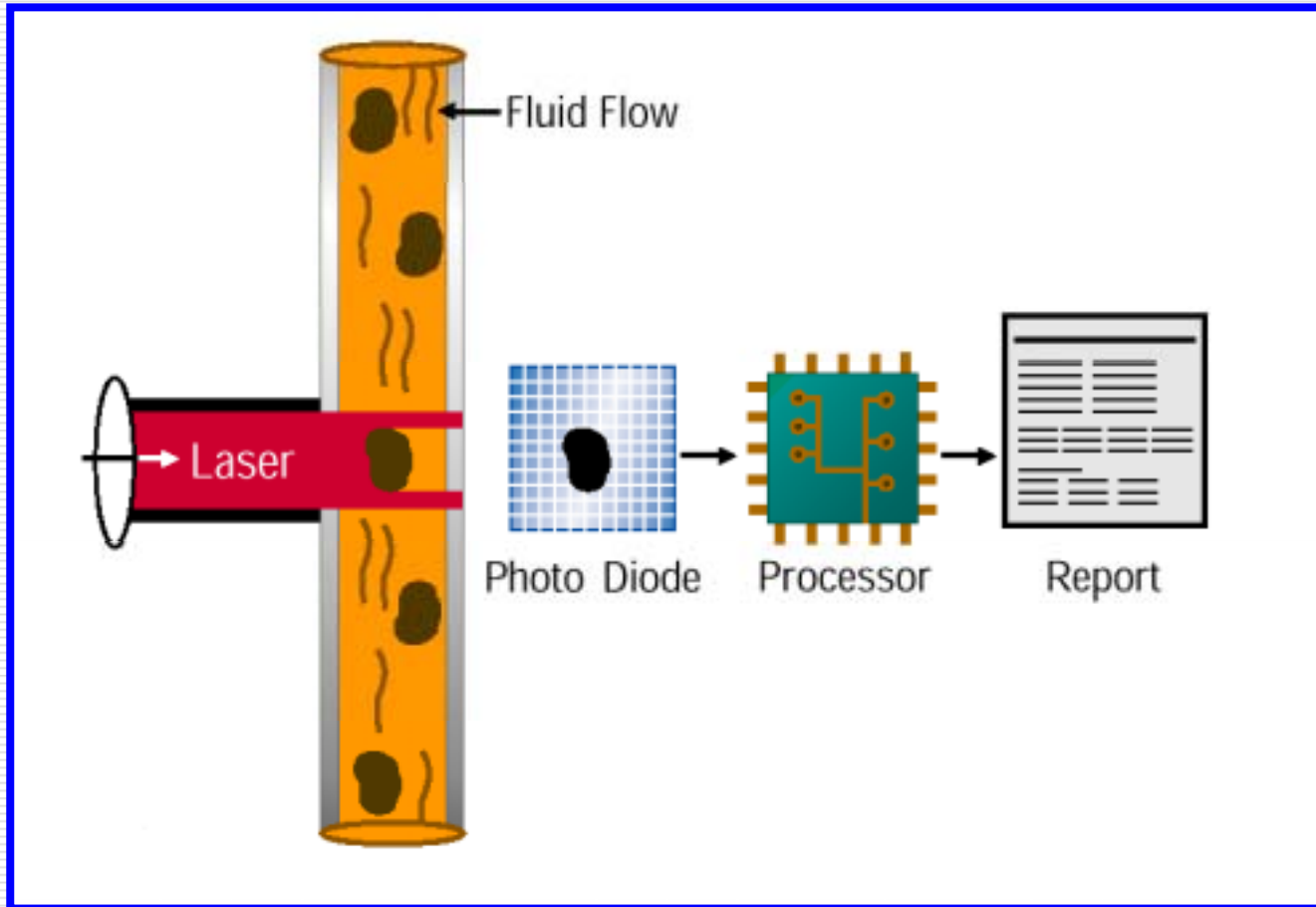
# 檢測技術

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- 雜質Particle
- 水份Water

# Particle counting technology

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# 檢測技術

## □ 顆粒



### UCC LASER CM ON-LINE TEST

TEST NUMBER 017  
TEST BENCH RIG 8

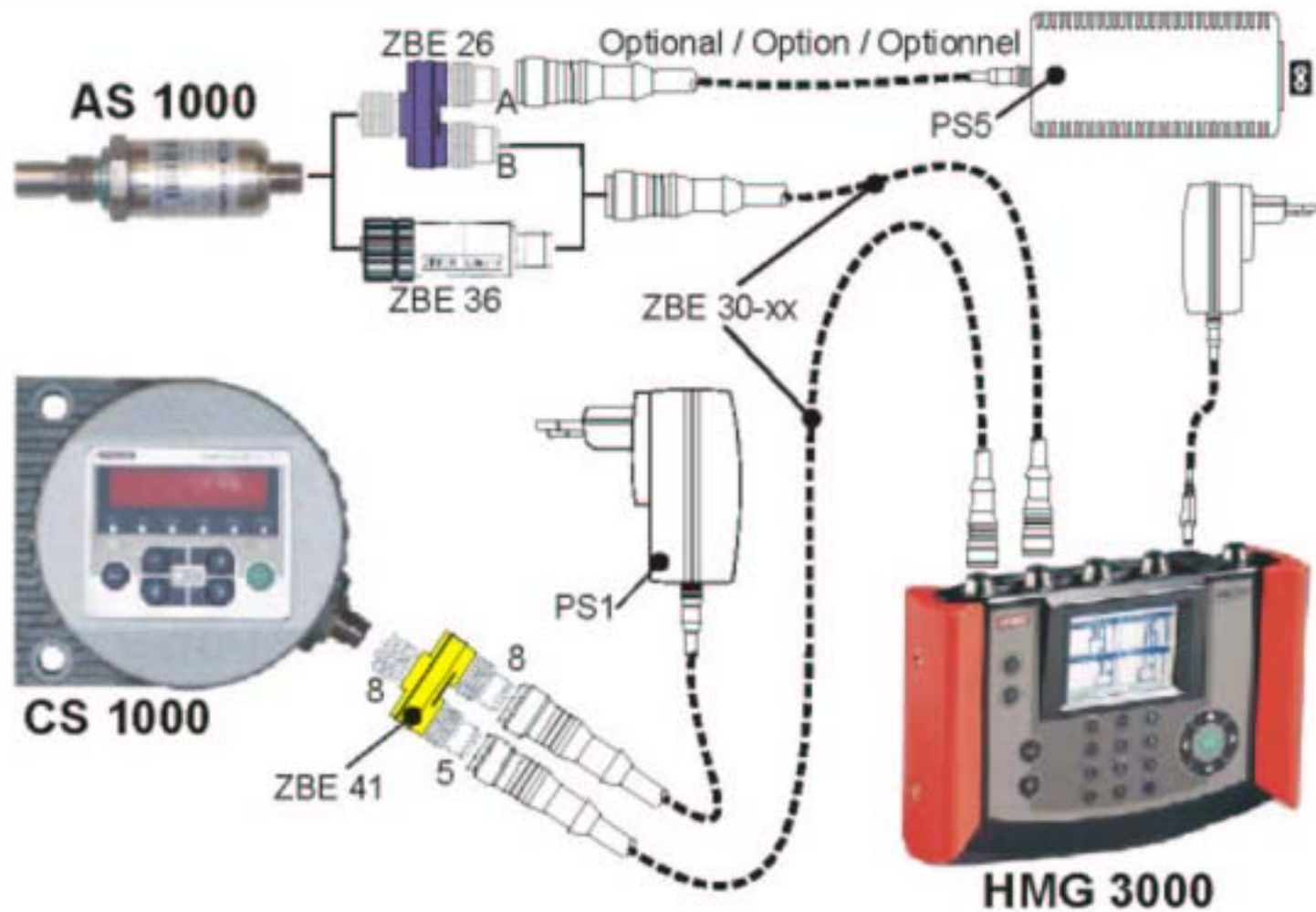
	D	M	Y
Date	24	11	04
Time		11	25
ISO:	20	17	13

Count / 100ml

>2 $\mu$	526243
>5 $\mu$	99607
>15 $\mu$	5760
>25 $\mu$	798
>50 $\mu$	22
>100 $\mu$	1



# 檢測技術



# Q & A

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