DAIKIN

# Hybrid System

# Sample Data File




SP-033MA

2007.1.15



DAIKIN INDUSTRIES,LTD.

Oil Hydraulic Division

Sales Panning Group

# INDEX

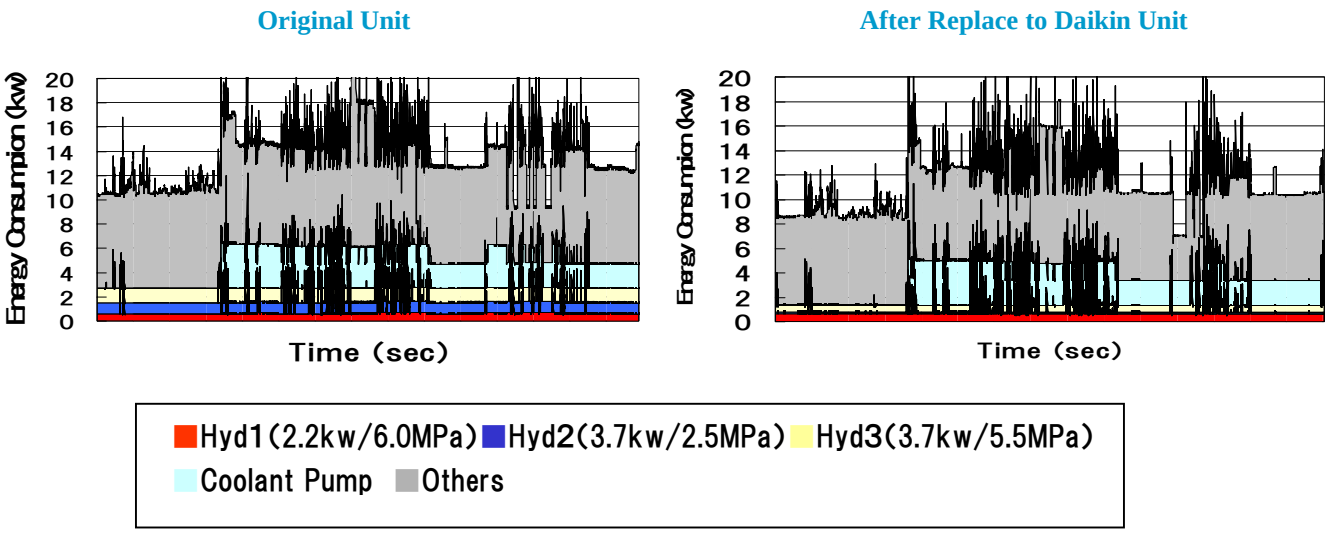
# Saving Energy

# Eco-Rich saving energy data sample

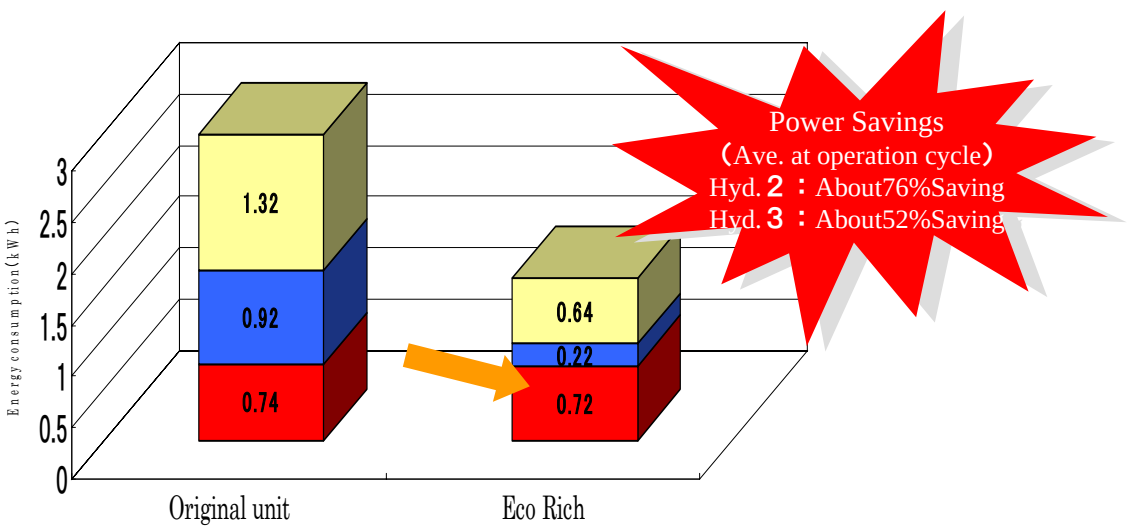
◆**Case A*** **( Car Manufacture )** 【 Machining Center 】

* There is a case also in a low noise.

## Comparison data between current unit and Daikin unit




## Comparison data between current unit and Daikin unit




## Specifications

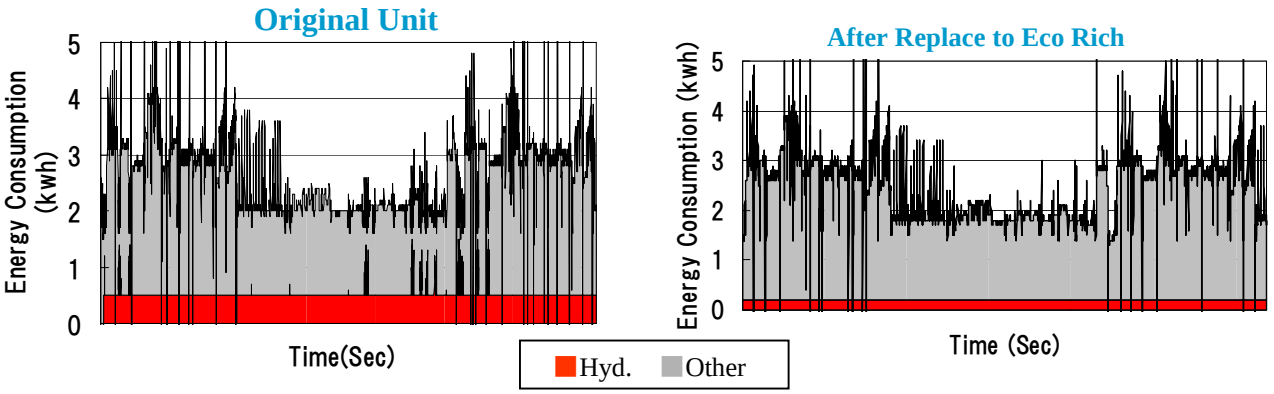
| | Pump type | Pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original unit 2 | Piston pump | 6.0 | 2.2kW | 250 |
| Original unit 3 | Piston pump | 2.5 | 3.7kW | |
| Eco Rich 2 | EHU40-M07-AE-10 | 6.0 | Equivalent 3.7kW | 30 |
| Eco Rich 3 | EHU40-M07-AE-10 | 2.5 | Equivalent 3.7kW | 30 |

0149T

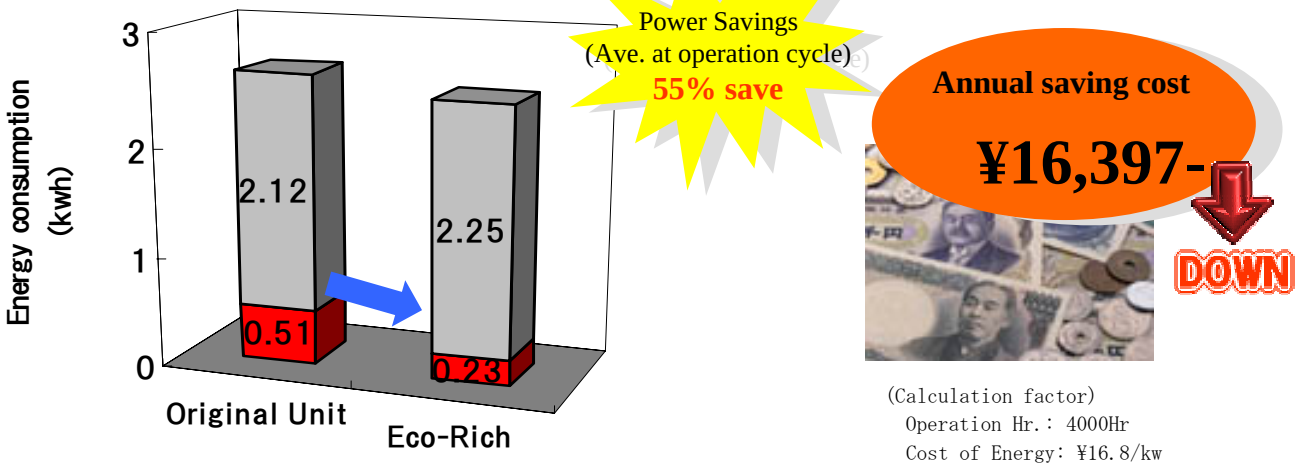
# Eco-Rich saving energy data sample

◆ **Case** B*　　**(Automobile parts manufacture)** **[ NC Lathe]**

## Comparison data between current unit and Daikin unit



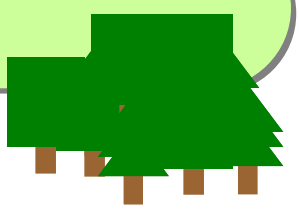

## Comparison data between current unit and Daikin unit




(Calculation factor)
Operation Hr.: 4000Hr
Cost of Energy: ¥16.8/kw

## Annual CO2 emission Reduction 1105kgCO2/kwh

Equivalent of planting 79 cedar trees



* Calculate factor: 14kgCO2 accumulate/tree annually
referring report of Environment ministry and Tree and field office

## Specifications

| | Pump type | Operating Pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original unit | Piston pump V15A1R-80 | 3.5 | 2.2 | 30 |
| Eco-Rich | EHU15-L07-AE-30 | 3.5 | 2.2 | 10 |

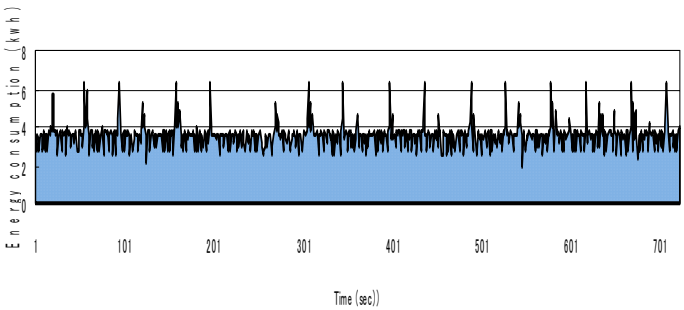
0189D

# Eco-Rich saving energy data sample

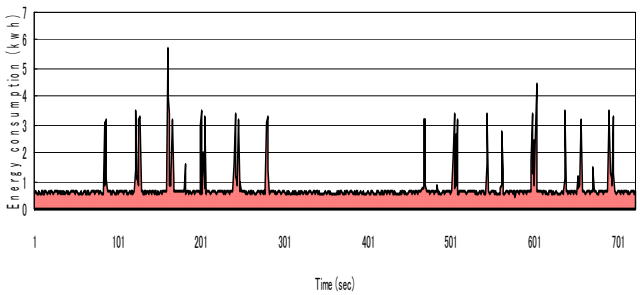
## ◆ Case C (Car Manufacture) [Hob Machine]

### Comparison data between current unit and Daikin unit

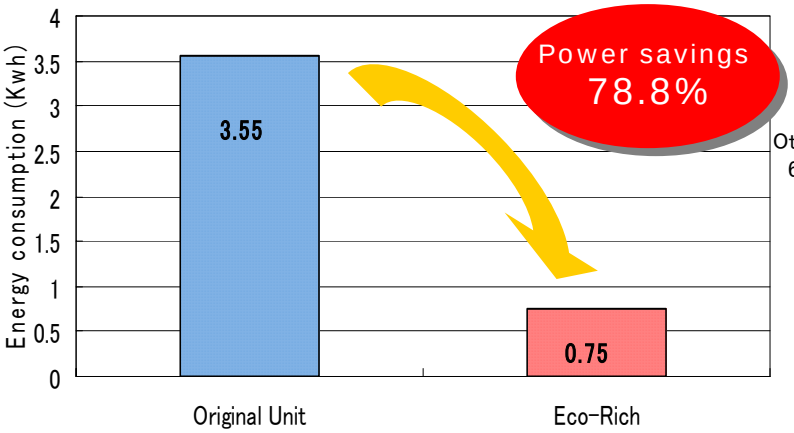
**Original Unit**



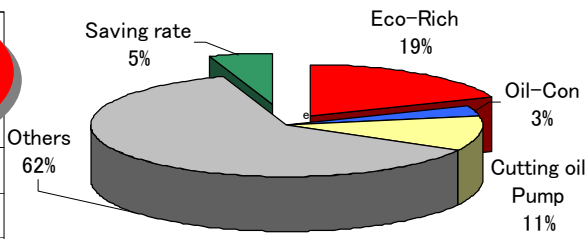

After replace to Eco-Rich




### Comparison data between current unit and Daikin unit




Energy data of total machine after replace (1000sec cycle)

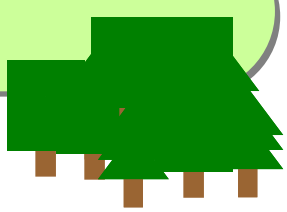



**Annual saving cost**
**¥141,924-**
DOWN

(Calculation factor)
Operation Hr.: 4224Hr
Cost of Energy: ¥12/kw

**Annual CO2 emission Reduction 5231kgCO2/kwh**

Equivalent of planting 375 cedar trees



* Calculate factor: 14kgCO2 accumulate/tree annually
referring report of Environment ministry and Tree and field office

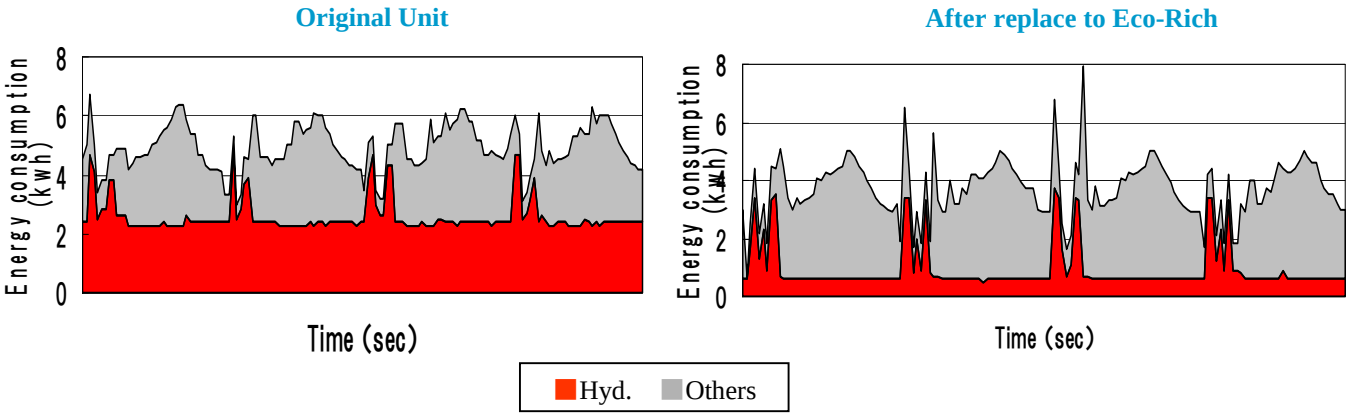
### Specifications

| | Pump type | Operating Pressure (MPa) | Motor size (kw) | Tank size (L) |
|---|---|---|---|---|
| Original unit | Piston pump NDR231-305-30-R | 7.0 | 3.7 | 30 |
| Eco-Rich | EHU40R-M07-A-10 | 7.0 | 3.7 | 30 |

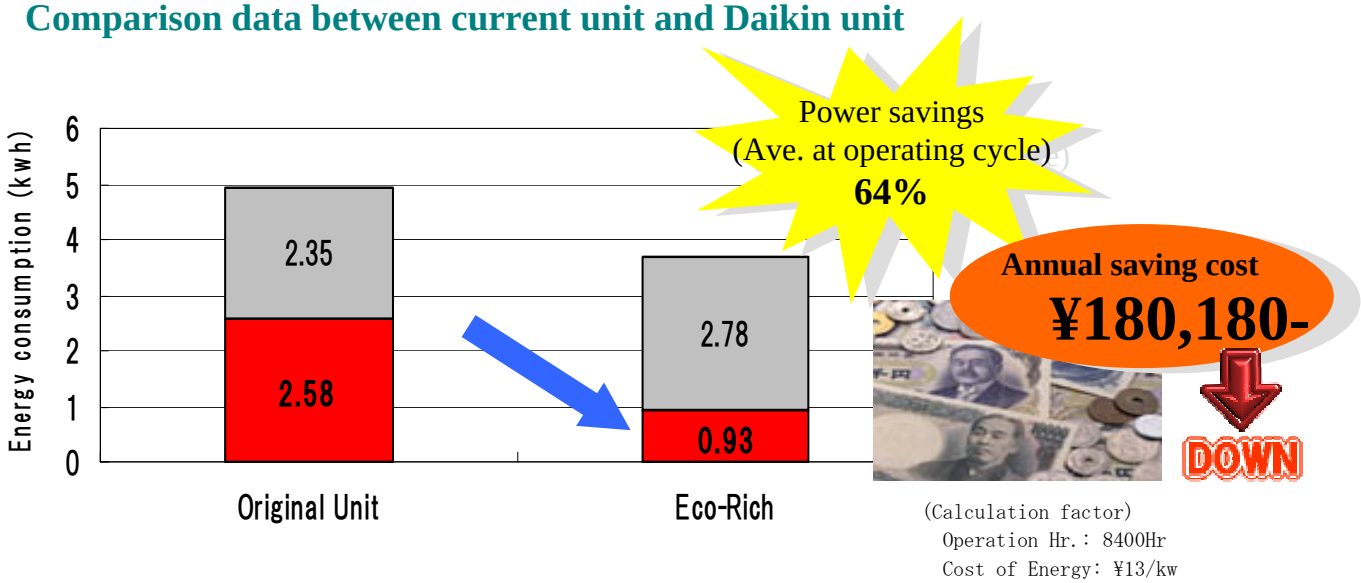
# Eco-Rich saving energy data sample

## ◆ Case D (Car parts manufacture) [ NC Hob Machine]

### Comparison data between current unit and Daikin unit



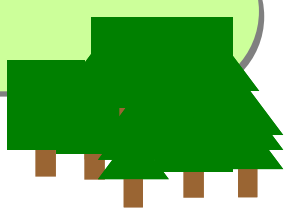

### Comparison data between current unit and Daikin unit




(Calculation factor)
Operation Hr.: 8400Hr
Cost of Energy: ¥13/kw

**Annual CO2 emission Reduction 5239kgCO2/kwh**

Equivalent of planting 376 cedar trees



* Calculate factor: 14kgCO2 accumulate/tree annually
referring report of Environment ministry and Tree and field office

### Specifications

| | Pump type | Operating pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original unit | Piston pump RP23A1-37-30 | 6.5 | 3.7 | 30 |
| Eco-Rich | EHU40R-M07-A-10 | 6.5 | 3.7 | 30 |

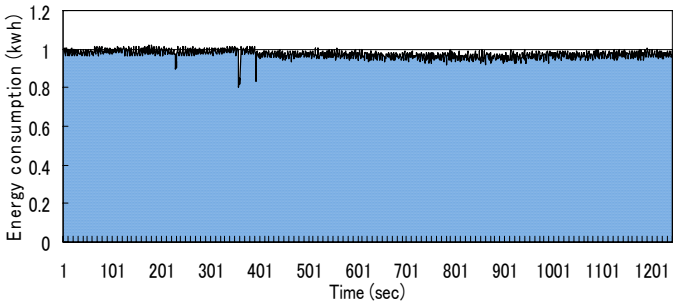
0008AI

# Eco-Rich R saving energy data sample

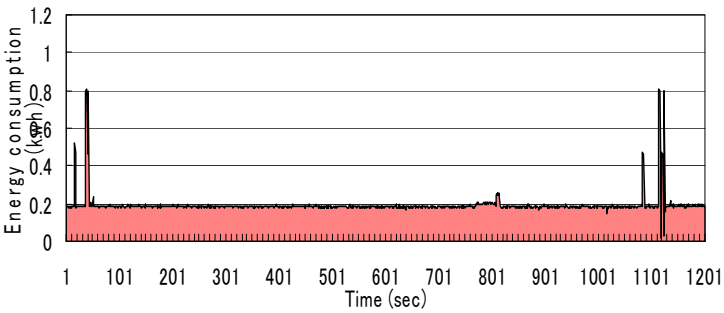
## ◆ Case E (Car parts manufacture) [ Special machine]

### Comparison data between current unit and Daikin unit

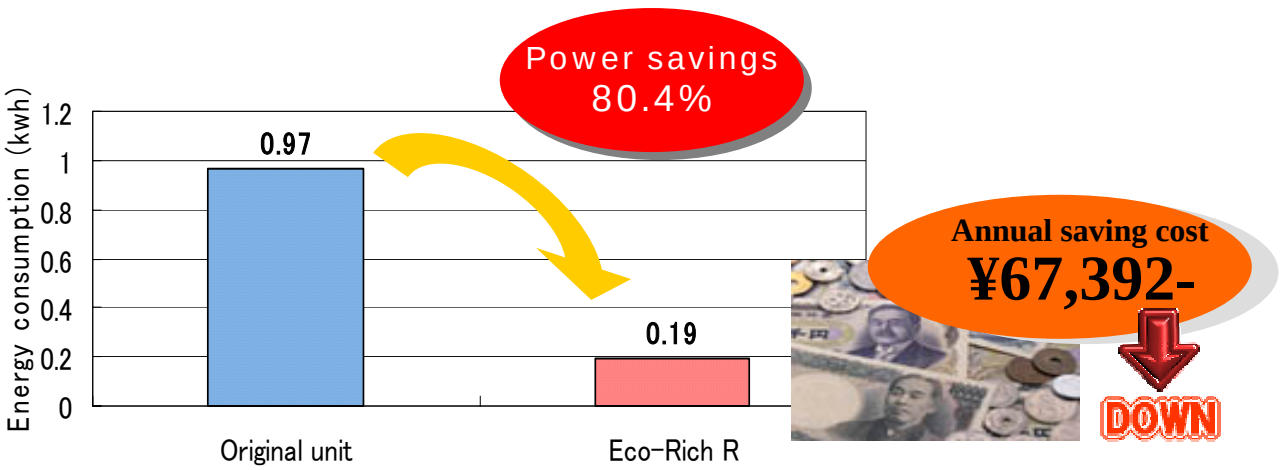
Original Unit




After replace to Daikin unit



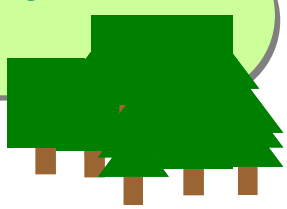

### Comparison data between current unit and Daikin unit




(Calculation factor)
Operation Hr.: 7200Hr
Cost of Energy: ¥12/kw

**Annual CO2 emission Reduction 2123kgCO2/kwh**

Equivalent of planting 152 cedar trees



* Calculate factor: 14kgCO2 accumulate/tree annually

referring report of Environment ministry and Tree and field office

### Specifications

| | Pump type | Operating Pressure (MPa) | Motor size (kw) | Tank size (L) |
|---|---|---|---|---|
| Original Unit | Piston Pump | 3.7 | 1.5kW | 60 |
| Eco Rich | EHU15R-M0702-10 | 4.0 | 2.2kW | 20 |

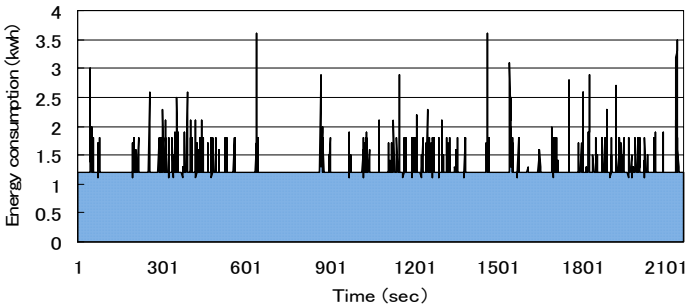
0405K

# Eco-Rich R saving energy data sample

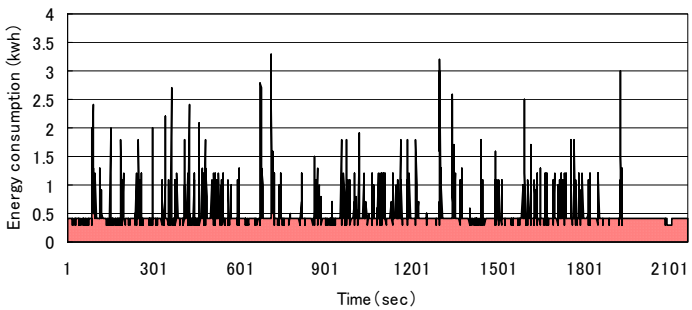
## ◆ Case F (Machine manufacture) [ Machining center]

### Comparison data between current unit and Daikin unit

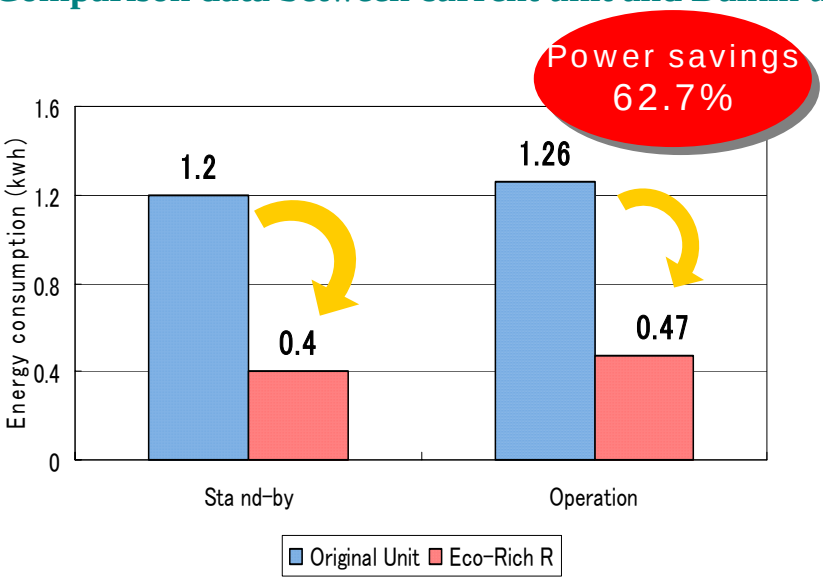
Original Unit

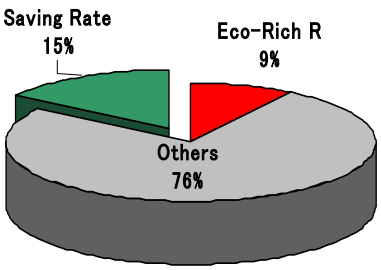



After replace to Daikin unit




### Comparison data between current unit and Daikin unit





(Calculation factor)
Operation Hr.: 3000Hr
Stand-by Hr.: 4200Hr
Cost of Energy: ¥15/kw

### Annual CO2 emission Reduction 2166kgCO2/kwh

Equivalent of planting 155 cedar trees

* Calculate factor: 14kgCO2 accumulate/tree annually

referring report of Environment ministry and Tree and field office

### Specifications

| | Pump type | Operating pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original unit | Piston pump NDR151-103L-30 | 5.5 | 2.2 | 10 |
| Eco-Rich | EHU30R-M0701-10 | 6.5 | 2.8 | 10 |

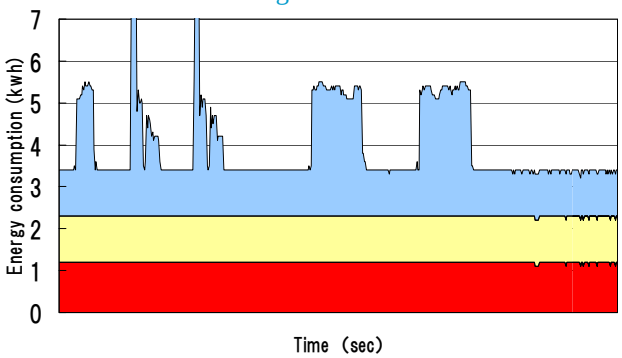
1062E

# Super unit saving energy data sample

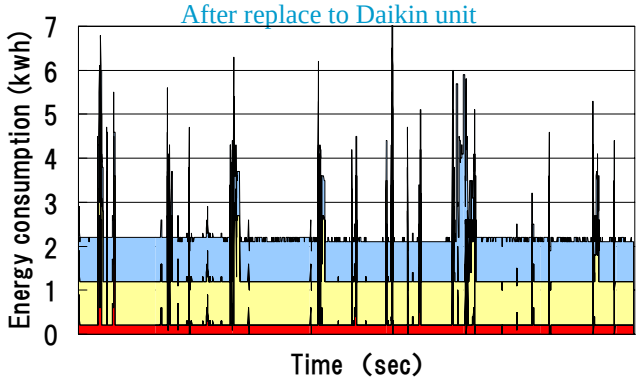
## ◆ Case G (Car parts manufacture) [ Machining center]

### Comparison data between current unit and Daikin unit

Original unit

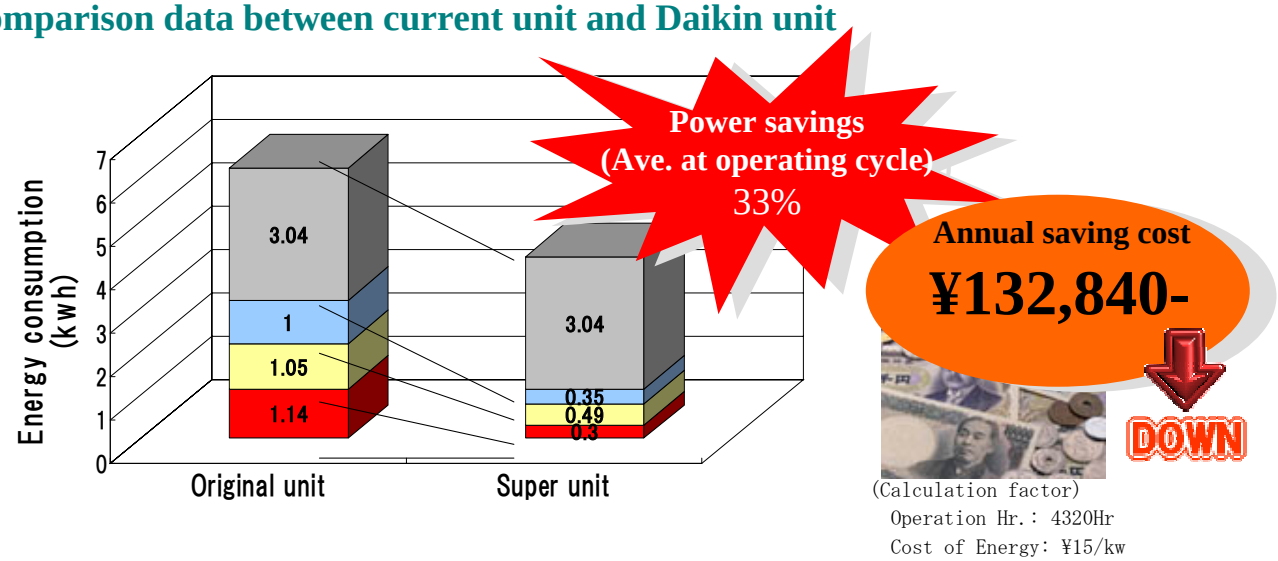



After replace to Daikin unit




Hyd. (main) Hyd. (ATC) Hyd. (PPL)

### Comparison data between current unit and Daikin unit




(Calculation factor)
Operation Hr.: 4320Hr
Cost of Energy: ¥15/kw

**Annual CO2 emission Reduction 3401kgCO2/kwh**

Equivalent of planting 244 cedar trees

* Calculate factor: 14kgCO2 accumulate/tree annually
referring report of Environment ministry and Tree and field office

### Specifications

| | Pump type | Operating pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original unit | Piston pump | 5.0 | 3.7 | 200 |
| Super unit | SUT10D60L21-10 | 5.0 | 5.0 | 100 |

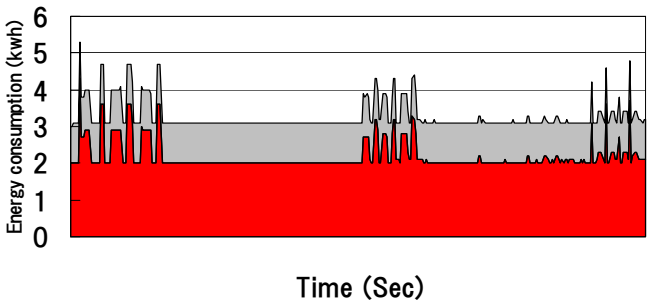
0231TJ

# Super unit saving energy data sample

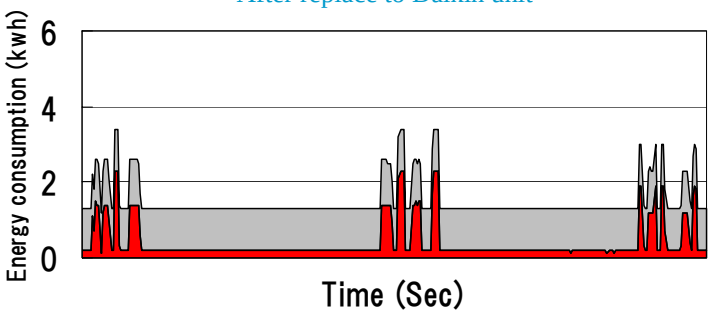
## ◆ Case H (Car manufacture) [ Balancing Machine (Special Machine)]

### Comparison data between current unit and Daikin unit

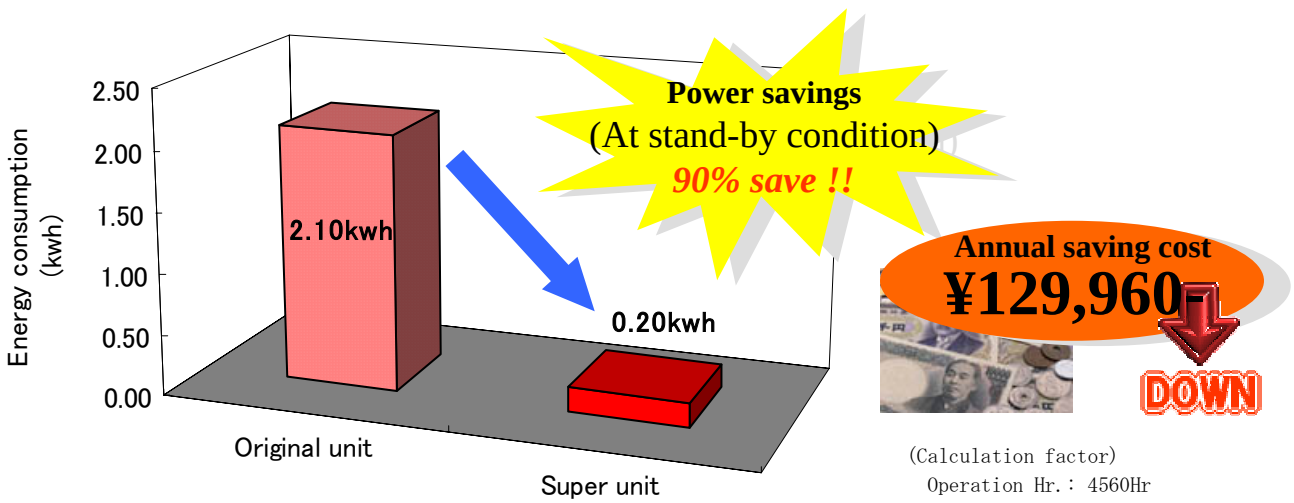
Original unit




After replace to Daikin unit




### Comparison data between current unit and Daikin unit




(Calculation factor)
Operation Hr.: 4560Hr
Cost of Energy: ¥15/kw

**Annual CO2 emission Reduction 3327kgCO2/kwh**

Equivalent of planting 238 cedar trees

* Calculate factor: 14kgCO2 accumulate/tree annually
referring report of Environment ministry and Tree and field office

### Specifications

| | Pump type | Operating pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original unit | Variable Vane | 3.5 | 3.7 | 350 |
| Super unit | SUT10D60L21-10 | 3.5 | 5.0 | 100 |

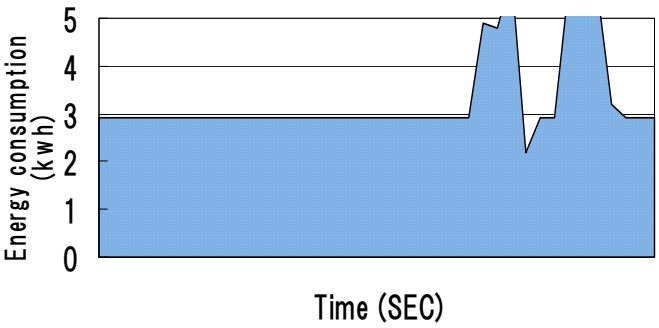
0246T

# Super unit saving energy data sample

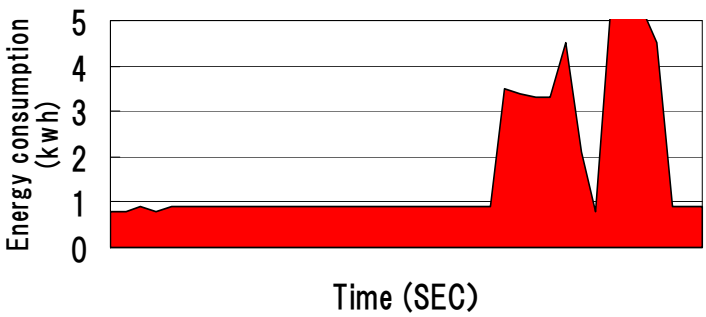
## ◆ Case I (Electric parts manufacture) [ Press Machine]

### Comparison data between current unit and Daikin unit

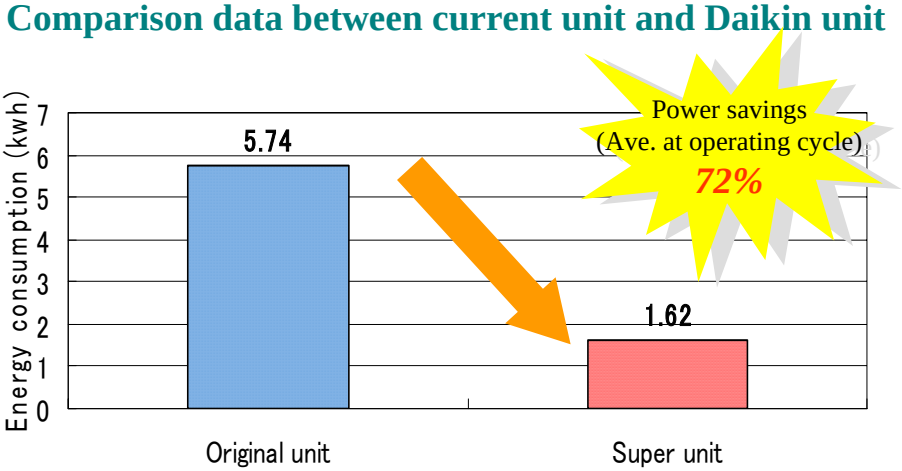
Original unit




After replace to Daikin unit




### Comparison data between current unit and Daikin unit





(Calculation factor)
Operation Hr.: 8000Hr
Cost of Energy: ¥15/kw

**Annual CO2 emission Reduction 3019kgCO2/kwh**

Equivalent of planting 216 cedar trees

* Calculate factor: 14kgCO2 accumulate/tree annually
referring report of Environment ministry and Tree and field office

### Specifications

| | Pump type | Operating pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original unit | Double gear | 12.5 | 5.5 | 200 |
| Super unit | SUT10D60L21-10 | 12.5 | 5.0 | 100 |

0266MS

# High Performance

# Super unit multi step Pressure/Flow control

1, Key factor to equip Super unit is “simple shock-less” function with multi step control.

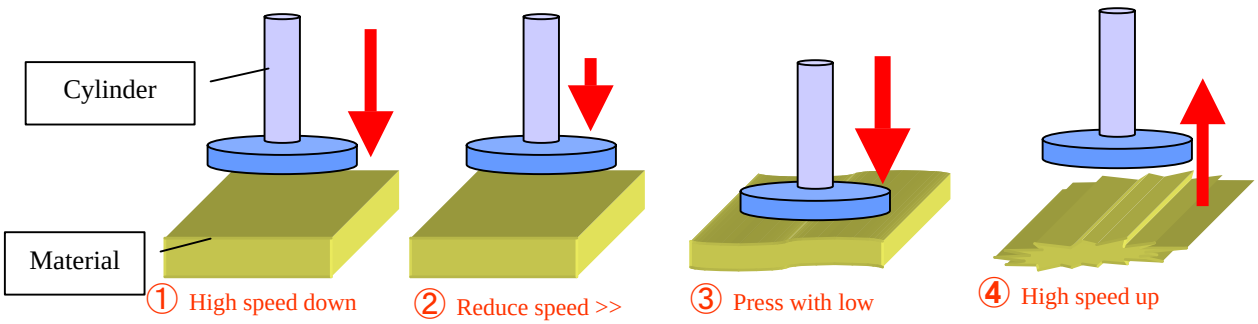
## ◆ Case J (Special machine manufacture) [ Press and forming machine]

This customer equipped “Super Unit” for Polyurethane Press Machine which are producing Car interior material. This machine process was required to set different pressure between press down and high speed upturn. Because polyurethane has specific character which is dented in pressing.

Conventional system was using 3 different Solenoid valve to adopt 3 different speed. After replace to Super Unit, this system was simplify because of multi set control feature.

### Specifications

| | Pump type | Pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original unit | Vane pump | - | 11 | 400 |
| Super unit | SUT10D60L21-11-F | PH:14.6 PL:3.0 | 5.0 | 100 |



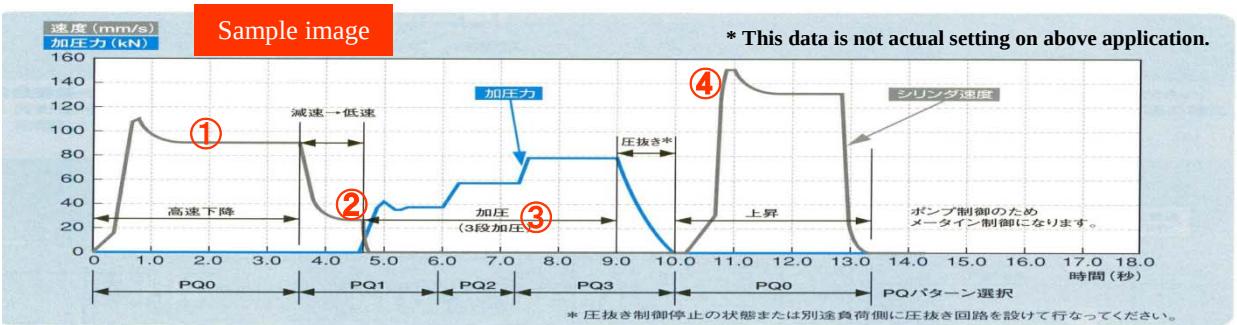

Cylinder is down with high speed

Reduce speed near to the material and down with slow speed

Press and form with low pressure.

After finished forming, cylinder is up with high speed.

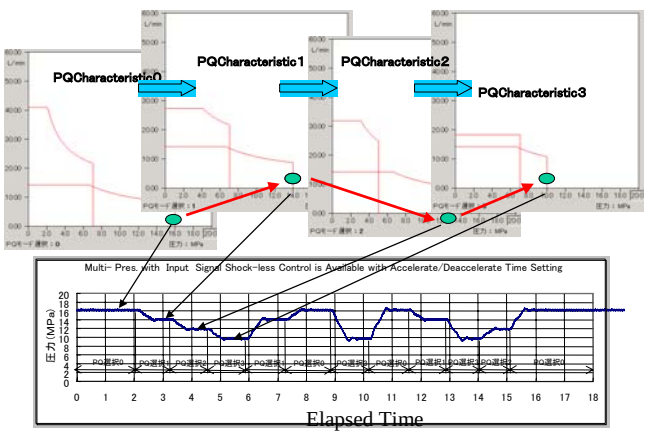
Sample image




Accelerate/decelerate time can be also set on Super Unit to avoid shock during switching pattern select.

### Super unit has sophisticated control feature addition to basic inverter control

Daikin hybrid unit achieved multi step pressure/flow control, which is difficult for general inverter drive unit, with fusion between original high efficiency IPM motor system and switching high/low pump system.
It is also possible to set shock-less control during switching in addition to 4 to 16 pattern change with input signal from machine.



# Eco-Rich R multi step Pressure/Flow control

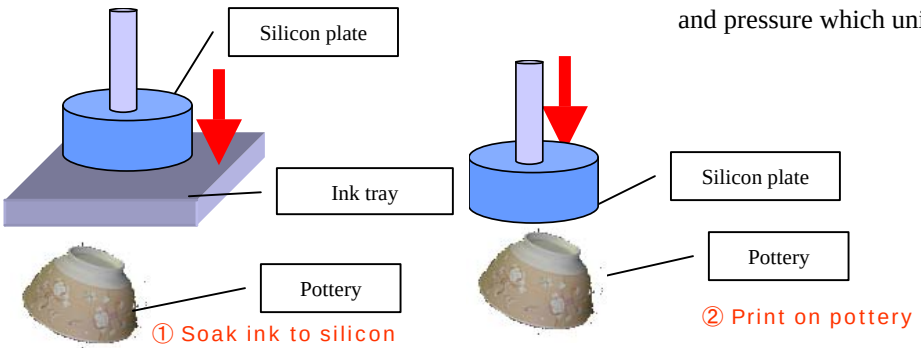
2. Key factor to equip Eco-Rich R is “easy speed control” and “simplify of system” with multi step P/F control feature.

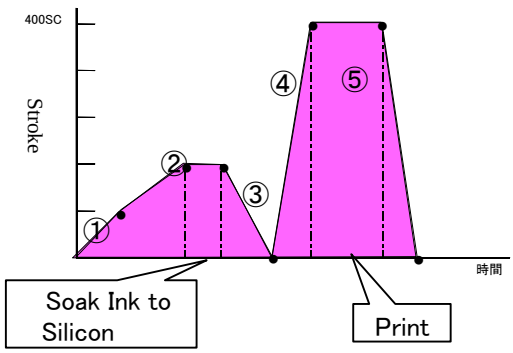
## ◆ Case K (Pottery manufacture) [ Press Machine]

### Specifications

| | Pump type | Pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original unit | Using pneumatic equipment | | | |
| Eco-Rich R | EHU30R-M0702-10-019 | 6.4 | 2.8 | 30 |

This customer equipped Eco-Rich R for Ceramic printing machine.
There was requirement to control speed of 1) soak ink to silicon plate, 2) printing pottery, more precisely. So they were examining to replace from pneumatic to electric servo control. But the cost of electric control is too high compare with hydraulic which has similar circuit with pneumatic. And Eco-Rich R didn’t need proportional valves for flow and pressure which unit can control by itself.

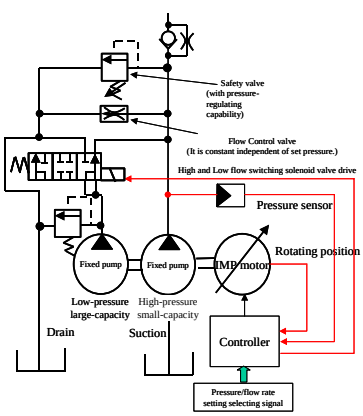


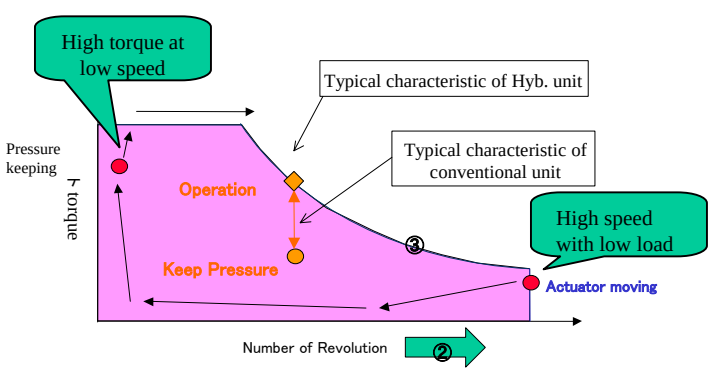




| | Speed | Move | Press. | Flow |
|---|---|---|---|---|
| ① | Mid | Down | low | 10ℓ/min |
| ② | Low | Down | low | 2.4ℓ/min |
| ③ | High | Up | 4MPa | 28ℓ/min |
| ④ | High | Down | 4MPa | 28ℓ/min |
| ⑤ | High | Up | 7MPa | 20ℓ/min |

**With using Eco-Rich R which can select pattern from flow control to pressure control, it is possible to simplify the system which had proportional control.**

Daikin hybrid unit is not just inverter unit, but offering additional function which can not do by conventional pump unit without couple proportional valve with individual electric control. Now you can make the system more simple and cost effective with using our hybrid products.



# Super unit communication function

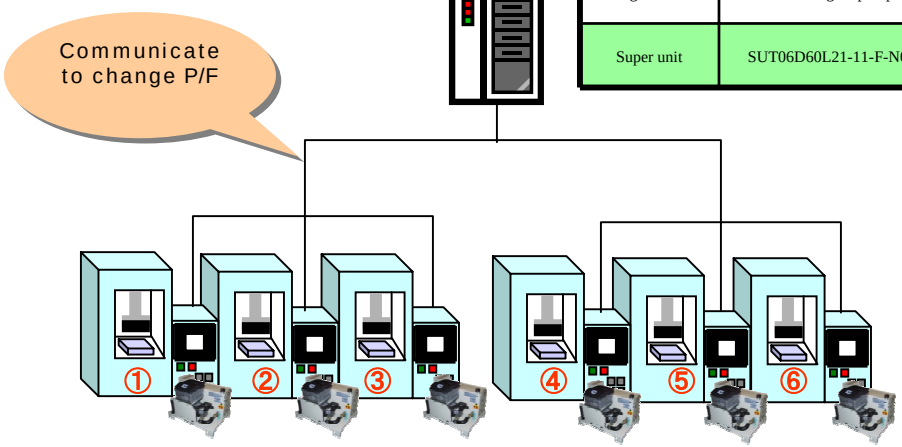
3, Key factor to equip Super unit is “communication function” with machine control which can change pressure/flow absolutely and keep as data.

## ◆ Case L (Car parts manufacture) [ Machining Machine ]

This customer is processing various parts with many machines. In this case, operator needs to adjust pressure/flow with handle manually and keep the record of change by hand too. To get higher productivity, this customer equipped Super unit to adjust pressure/flow from the server using communication function and keep the record of change as data automatically. According this modification, customer can standardize the process and get high productivity.

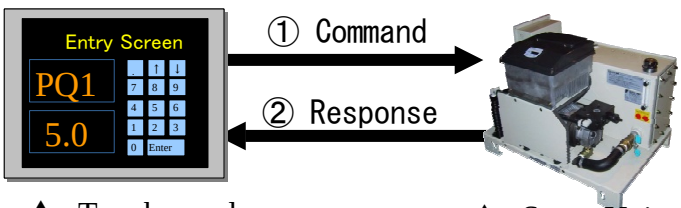
Specifications

| | Pump type | Operating pressure (MPa) | Motor size (kw) | Tank size (L) |
|---|---|---|---|---|
| Original unit | Fixed gear pump | 21 | 5.5 | 160 |
| Super unit | SUT06D60L21-11-F-N0111 | 21 | 5.0 | 60 |




### Hybrid can do not just pump function, but do more such as communication

Super unit has “Communication/Remote control function” which can read and write inside data of unit using optional communication device (PLC+Touch panel). (Standard unit has connection terminal, but not equipped communication function itself.)




▲ Touch panel

▲ Super Unit
(Photo of 2. 8kw type)

In addition to input on touch panel on the unit, Parameter can change from machine control panel as remote control. According this function, make the parameter change easy and select unit location freely. And to modify existing machine, it is easier to develop and modify hydraulic system.

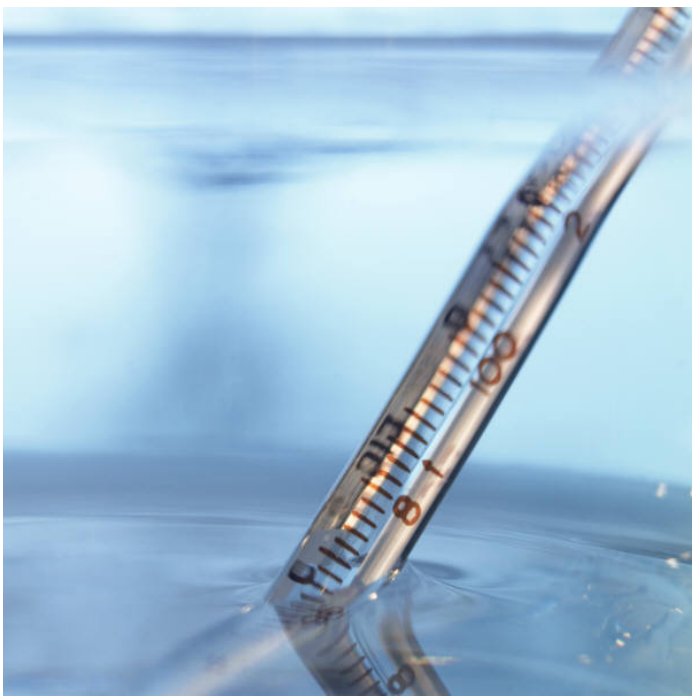
① Make parameter change of each unit easier

② No limit of unit location by remote control

③ Easy system development

④ Easy modification of existing hydraulic system

# Low Heat Volume

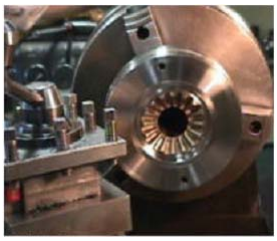


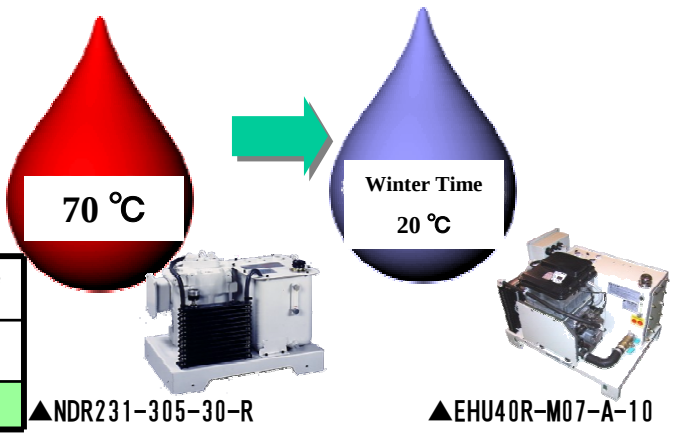
# Eco-Rich R series low heat volume

## ◆ Case M (Car manufacture) [ Hob Machine ]

Oil Temp. down 50`C

Eco-Rich R






▲NDR231-305-30-R ▲EHU40R-M07-A-10

Specifications

| | Pump type | Operation pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original unit | Piston Pump NDR231-305-30-R | 7.0 | 3.7 | 30 |
| Eco-Rich | EHU40R-M07-A-10 | 7.0 | 3.7 | 30 |

Eco-Rich series unit can reduce 50`C (20`C in winter season = +10`C from room temp.) comparing with conventional piston pump system. In summer time, save HVAC cost too.
Heat volume of oil is effected on not just ambient condition, but effected on life time of seals on each equipment. If O-rings have damage, oil leakage would be occurred.
Conventional induction motor is running at same speed all time and wasting energy. On the other hand, high efficiency IPM motor system which equipped Eco-Rich series can cut the wasting energy at stand-by situation by reduction of rotation speed at minimum. This means that cut the heat volume generated by wasting energy.

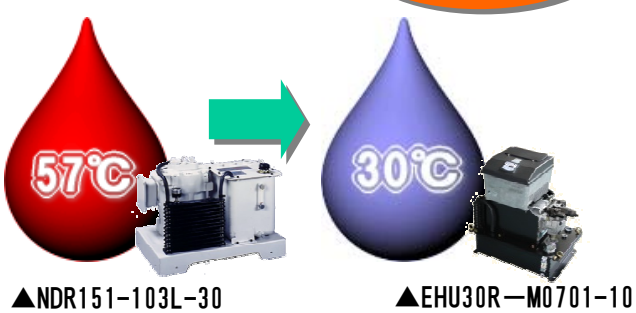
## ◆ Case N (Machine manufacture) [ Machining Center ]

Oil temp. down 27`C

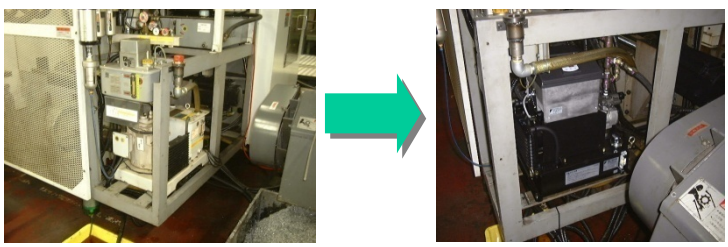
Eco-Rich R

Specifications

| | Pump type | Operation pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original unit | Piston pump NDR151-103L-30 | 5.5 | 2.2 | 10 |
| Eco-Rich R | EHU30R-M0701-10 | 6.5 | 2.8 | 10 |




▲NDR151-103L-30 ▲EHU30R—M0701-10



# Eco-Rich R low heat volume

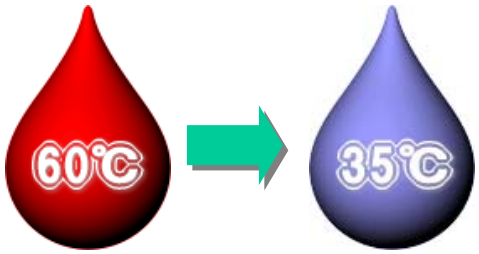
## ◆ Case O (Car manufacture) [ Machining Center ]

Oil temp. down 35`C

Eco-Rich R

Specifications

| | Pump type | Operation pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original pump | Piston pump | 2.5 | 1.5 | 63 |
| Eco-Rich R | EHU30R-M0702-10 | 3.5 | 2.8 | 20 |



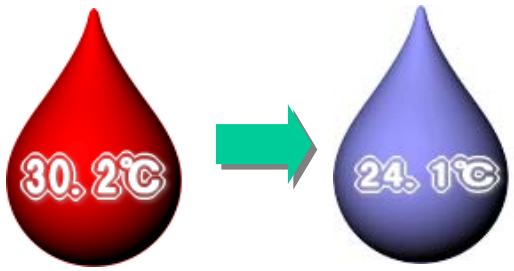

## ◆ Case P (Machine parts manufacture) [ Screw Grinding Machine ]

Oil temp. down 6.1`C

Eco-Rich R

Specifications

| | Pump type | Operation pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original pump | Piston pump | 5.0 | 1.5 | 58 |
| Eco-Rich R | EHU30R-M0702-10 | 5.0 | 2.8 | 20 |



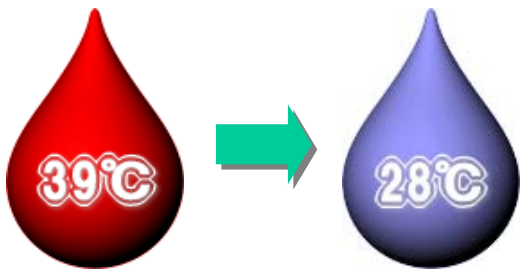

## ◆ Case Q (Car parts manufacture) [ Hob Machine ]

Oil temp. down 11`C

Eco-Rich

Specifications

| | Pump type | Operation pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original pump | Variable Vane Pump | 4.0 | 1.5 | 50 |
| Eco-Rich | EHU25-M07-AR-30-V-077 | 4.0 | 2.8 | 10 |



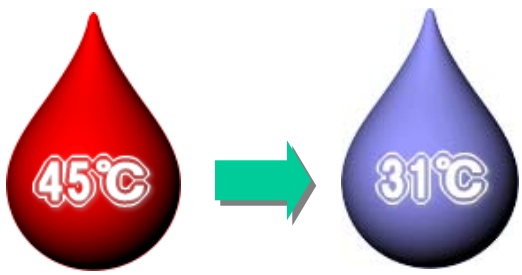

## ◆ Case R (Car parts manufacture) [ Machining Center ]

Oil temp. down 14`C

Eco-Rich R

Specifications

| | Pump type | Operation pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original pump | Variable Vane pump | 6.5 | 2.2 | 20 |
| Eco-Rich R | EHU30R-M0702-10 | 6.5 | 2.8 | 20 |



# Super unit low heat volume

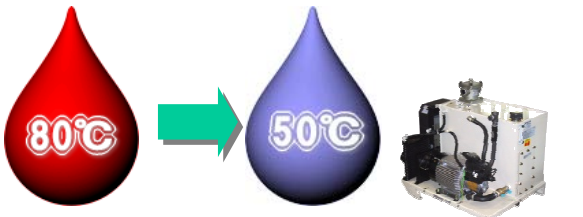
## ◆ Case S (Machine manufacture) [ Multi Purpose Cutting Machine ]

Oil temp. down 30`C

Super Unit

Specifications

| | Pump type | Operation pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original pump | Vane pump DVMB-3V-20 | 7.0 | 11.0 | 180 |
| Super unit | SUT16D80L21-10-F | PH: 11.0 PL: 3.0 | 7.0 | 160 |




▲DVMB-3V-20 (Vane Pump)

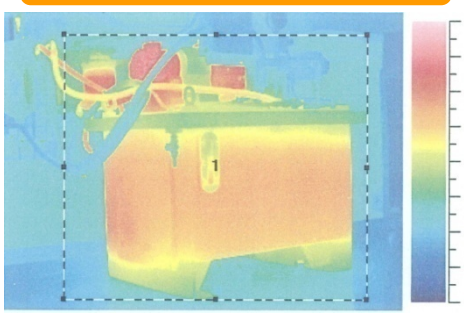
▲SUT16D80L21-10-F

Oil temp. was increased 80`C in conventional unit and paint on machine was removed because of heat.
After replace to Super Unit, oil temp. became 50`C and problem was solved. Moreover oil cooler could be deleted from system. As the result, machine cost is also reduced.

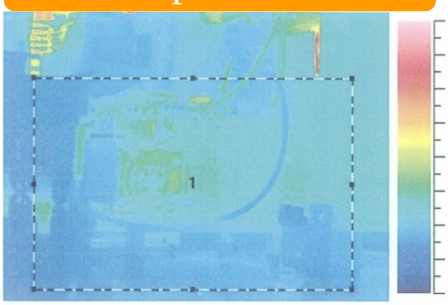
## ◆ Reference data * This data is not related with Case S.

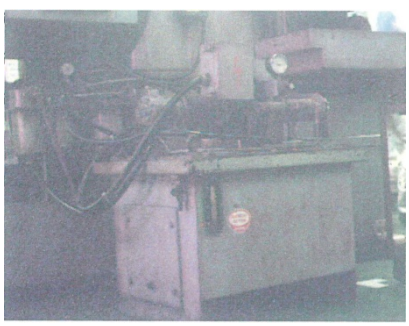
Thermograph Temp. data on hydraulic unit

Conventional unit



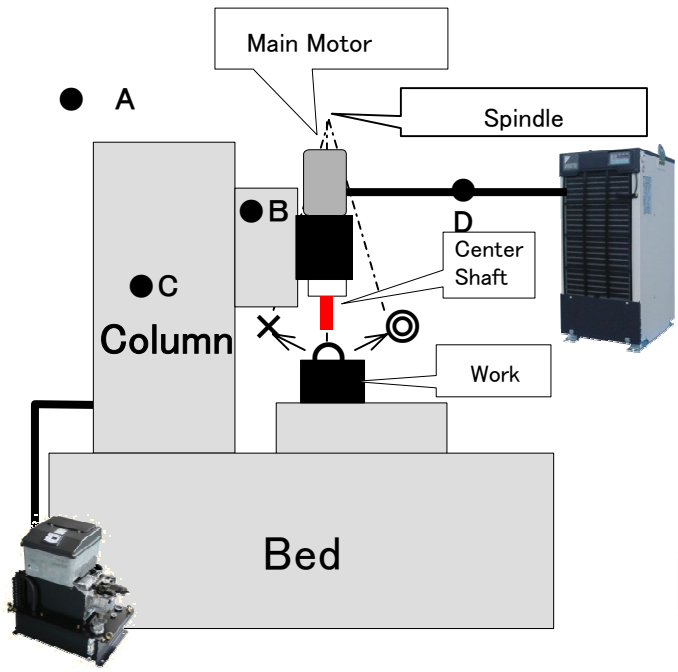
Super Unit





# Merit on machine with low heat volume

## 1, Higher machining accuracy



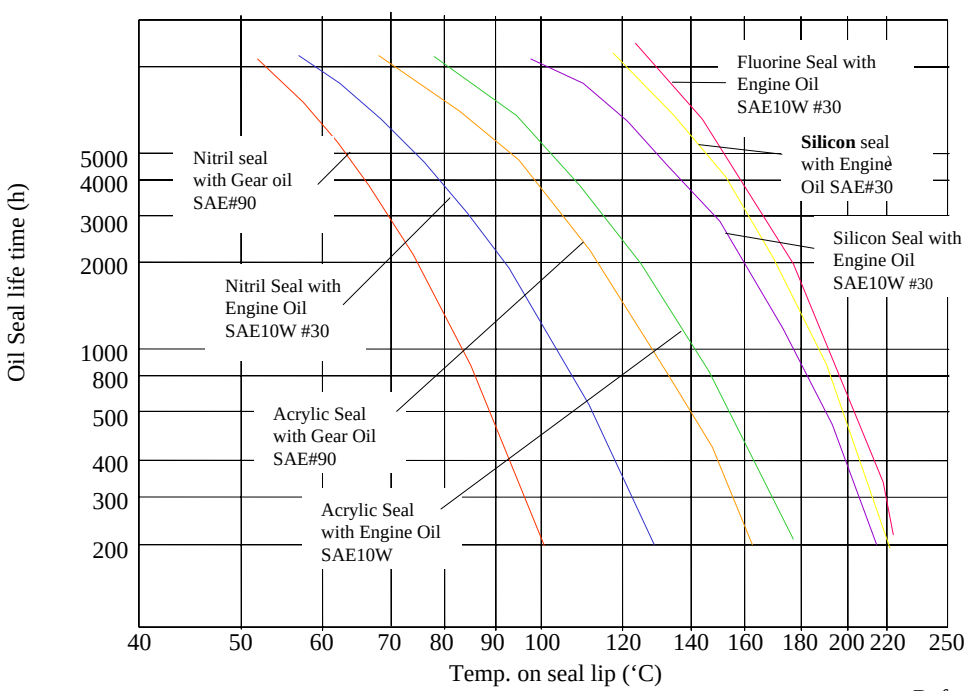

Here is explanation of general situation between Machine and ambient temperature.
Most concerning point of machine accuracy is movement of spindle center. One of the cause of the movement is generation of heat from spindle bearing. This heat is transferred to spindle head and column and change the distance (X) between spindle center and column.
Depends on heat volume, spindle center move from point (O) to point (◎).
In this case, those movement is avoided by reducing temp. controlled by spindle cooling unit.
To get higher accuracy, need to reduce heat volume of every points as much as possible.
So reducing heat volume from hydraulic unit with hybrid is effective way to solve this situation.

( A : Room Temp. B : Gear Box
C : Column D : Working oil )

## 2, Longer life time of seals => reduce oil leakage problem and improve maintenance

Main cause of shorten life time of seals is damage on seal lip. Actually, lips get hardening, softening, cut and creeping when lips material has damage. Generally, high temp. of oil makes those damage faster and effected life time of seals. For example, Sliding face of oil seal has also got hardening and cut at lip part and loose tightness.

Oil Seal life time according kind of oil and seal material (Sample)




Reference:
NOK Test Bench

# Merit on machine with low heat volume

### 3, Longer life time of working oil =>> Reduce wasting oil, cost and improve maintenance

[ Applicable oil temperature ]

As characteristic of oil, Viscosity of oil is getting thin at high temp. and getting thick at low temp. The low viscosity is cause of leakage, low efficiency, low accuracy and low lubrication. On the other hand, the high viscosity is cause of difficulty of start pump, longer warming up, loss of energy and delay of response. Moreover high temp. accelerate oxidation and life time is shorten.

■Applicable temp. of each oil type

| | |
|---|---|
| Mineral working oil | 40～60℃ |
| Working oil Included water glycol | 40～50℃ |
| Working oil (included phosphoric acid) | 40～60℃ |

■Suitable oil temp. of each operation

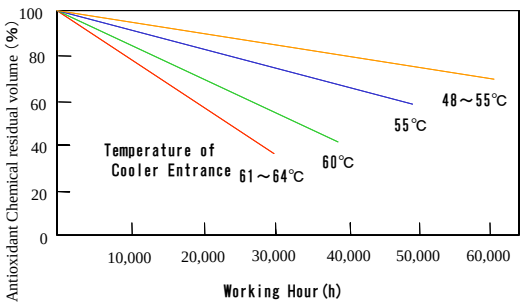
| | |
|---|---|
| Lowest temp. for start | 10～15℃ |
| Warming up | 15～30℃ |
| Operation | 30～70℃ |
| Max. temp. | 70～80℃ |
| Warning temp. | 80℃ |

Reference: Idemitsu Oil Company Data

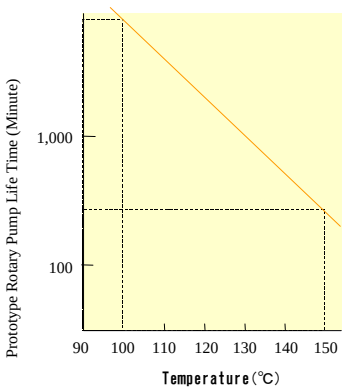
[ Relation between oil temp. and damage ]

Most effective cause of oil damage is temp. If oil temp. increase 10`C over 60`C, oxidation of oil occurred in twice speed.

■Relation between oil temp. and consumption speed of oxidation protect chemical




■ Relation between oil temp. and oil life time
(Test data of RP series Piston pump)




Reference: Idemitsu Oil Company Data

## 4, Reduce HVAC cost

Major HVAC type and merit of low heat type hydraulics

■ Constant Temp. and Humidity control

Constant temp. and humidity control means keeping temp. and humidity stabile within tolerance. This control is needed to keep accurate machining, protecting rust and correct measuring procedure. Usage of low heat volume hydraulics such as hybrid type contributes to save HVAC cost too.

Applicable temp. range of each process (Sample data)

| Classification | Process | temperature (℃) | Relative Temperature (%) |
|---|---|---|---|
| Precison Machinery | Spectral Analysis | 24～26.5 | 45～50 |
| | Gear Assembling | 24～26.5 | 35～40 |
| | Precision Parts Fabricating | 24 | 45～50 |
| | Precision Gauge Adjusting | 20～24 | 45～50 |
| | Precision Honing | 24～26.5 | 35～45 |

■ Standard HVAC system

General HVAC system is very simple temp. control which cool the air when temp. is high, warm the air when temp. is low. In this case, ambient situation is effected by heat volume easier and accuracy control is difficult. Using low heat volume hydraulics is best solution for this situation too.

# Low noise

# Low Noise of Eco Rich / Eco Rich R / Super Unit

## ◆ Case R (Car manufacture) [ Machining Center ]

Specifications

| | Pump type | Operating pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original unit 1 | Piston pump | 6.0 | 2.2 | 250 |
| Original unit 2 | Piston pump | 2.5 | 3.7 | |
| Eco-Rich 1 | EHU40-M07-AE-ET | 6.0 | 3.7 | 30 |
| Eco-Rich 2 | EHU40-M07-AE-ET | 2.5 | 3.7 | 30 |

Eco-Rich

Noise reduction
(Ave. at operation)
5.5db(A)
DOWN

Original unit : 76.5(A)Ave.
Eco-Rich : 71db(A)Ave.

Noise level

| | DH/FF Vibration | DH Noise Level | FF Noise Level |
|---|---|---|---|
| Original Unit2( 3.7Kw-2.5MPa) | — | 76dB | 77dB |
| Original Unit3( 3.7Kw-5.5MPa) | 0.6／1.5MPa | 77dB | 78dB |
| Eco Rich 2( 3.7Kw-2.5MPa) | — | 71dB | 73～75（Peak 77）dB |
| Eco Rich 3( 3.7Kw-5.5MPa) | 0.3／1.4MPa | 71dB | 74～76（Peak 78）dB |
| | DH ◎、FF ○ | ↑Refered Number | ↑Refered Number |

## ◆ Case S (Car parts manufacture) [ NC Milling Machine ]

Specifications

| | Pump type | Operation pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original pump | Piston pump | 5.5 | 2.2 | 10 |
| Eco-Rich R | EHU30R-M0702-10 | 5.5 | 2.8 | 20 |

Eco-Rich R

Noise reduction
(Ave. at operation)
4db(A)
DOWN

Original unit : 75db(A)Ave.
Eco-Rich R : 71db(A)Ave.

## ◆ Case T (Aluminum building material manufacture) [ Press Machine ]

Specifications

| | Pump type | Operation pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original pump | Piston pump | 21.0 | 3.7 | 80 |
| Super Unit | SUT06D60L21-11-F | 21.0 | 5.0 | 60 |

Super Unit

Noise reduction
(Ave. at operation)
11db(A)
DOWN

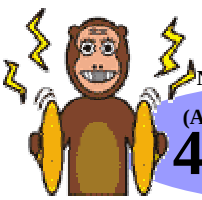
Original unit : 80db(A)Ave.
Super Unit : 69db(A)Ave.

## ◆ Case U (Transportation machine manufacture) [ Machining Center ]

Specifications

| | Pump type | Operation pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original pump | Piston pump | 6.0 | 3.7 | 80 |
| Super Unit | SUT06D60L21-11-F | 6.0 | 5.0 | 60 |

Super Unit



Noise reduction
(Ave. at operation)
4db(A)
DOWN

Original unit : 80db(A)Ave.
Super Unit : 76db(A)Ave.

# Others

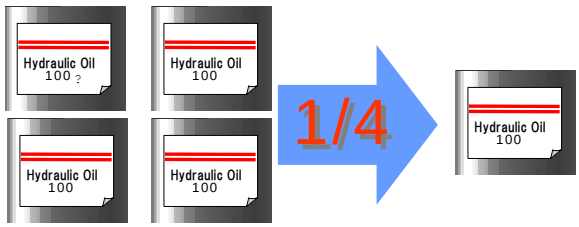
# Other key point

## ① Minimize of oil tank

### ◆ Case V (Special machine manufacture) [ Polyurethane Press Machine ]

Specifications

| | Pump type | Operation pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original pump | Vane pump | ? | 11.0 | 400 |
| Super Unit | SUT10D60L21-11-F | PH: 14.6<br>PL: 3.0 | 5.0 | 100 |



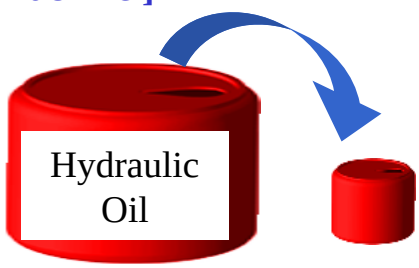

Super Unit can adjust pressure and flow with motor speed control with equipped high efficiency IPM motor system. And this system control speed as much as required without wasting energy. This means this system can cut excess heat and keep working oil temp. low. According this merit, tank size is minimize on Super Unit, this is, reduce mounting space, oil consumption and maintenance cost for both purchasing oil and wasting oil.

## ② Smaller mounting space and assembling time

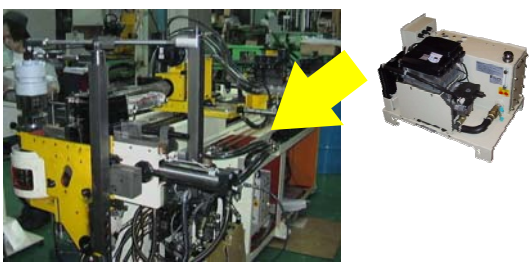
### ◆ Case W (Machine manufacture) [ Pipe bending machine ]

Specifications

| | Pump type | Operation pressure (MPa) | Motor size (kw) | Tank size (ℓ) |
|---|---|---|---|---|
| Original pump | Piston pump<br>M38A2X-10-50 | 7.0-10.0 | 7.5 | 300 |
| Super Unit | SUT03S30L10-10-F | 10.0 | 3.7 | 30 |




Wasting oil reduced 1/10



This customer was assembling unit by themselves because of size of tank. They required small package which can mount in the limited space (shown => sign). Super unit can save the mounting space and oil consumption too because of high efficient IPM system. Tank size of original unit was 300L. But after replaced to Super unit, tank size became 1/10 which is 30L. This make assembling time shorter and machine size smaller.

Reduce assembling time too

**15 Hours** → **0 (Zero) Hour**

To assemble original unit took about 15 hours because of the parts number (11 different parts). After replaced to Super unit, the assembling time became “0” because of completed package concept.