

## 단조용 가열로의 버너시스템에 대한 고찰

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## Furnace & Forging

### Key Technology

- Low Oxidation
- Rapid Heating
- Uniform Temp. Distribution
- Low Nox
- High Efficiency Burner Control System
- Low Cost

### Processes

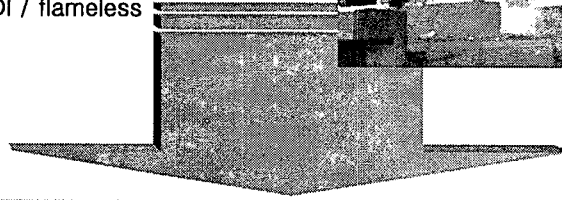
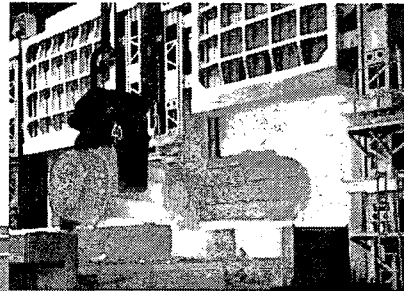
- Open-Die Forging
- Closed-Die Forging
- Hot Upset Forging
- Roll Forging
- High-Energy-Rate Forging
- Ring-Rolling
- Radial Forging
- Rotary forging

친환경 고효율 단조 가열시스템 -> 버너시스템

## 최신 단조용 가열로는

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- 새로운 환경친화적 기술 개발 및 적용
- 직화버너 / 축열버너 시스템
- 상대적으로 낮은 화염 유도  
-> FDI / flameless



축열 및 FDI이 기술을 적용한 친환경 고효율 단조용 가열로

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## CASE STUDY

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Design specification

<b>FURNACE TYPE</b>	<b>BOTTOM CAR TYPE</b>		
<b>APPLICATION</b>	<b>REHEATING OF INGOT</b>		
<b>ZONE</b>	3		
<b>TEMPERATURE</b>	1270℃ . Max 1300℃		
<b>BURNER TYPE</b>	REGENERATIVE , BALL , FDI		
<b>BURNER CAPACITY / PAIR</b>	1,500,000Kcal/Hr , 4 PAIR		
<b>CASING OUT SIDE DIMENSION</b>	8100W • 7400H • 14250L		
<b>EFFECTIVE WORKING ZONE</b>	5000W • 3500H • 11000L		
	<b>HEATING Capa.</b>	<b>LOAD(car frame)</b>	<b>LOAD(driving)</b>
<b>INGOT</b>	25.5•5ea = 128ton		
<b>SUPPORT</b>	14ton•6ea = 84ton		
<b>TOTAL</b>	212ton	300ton	400ton

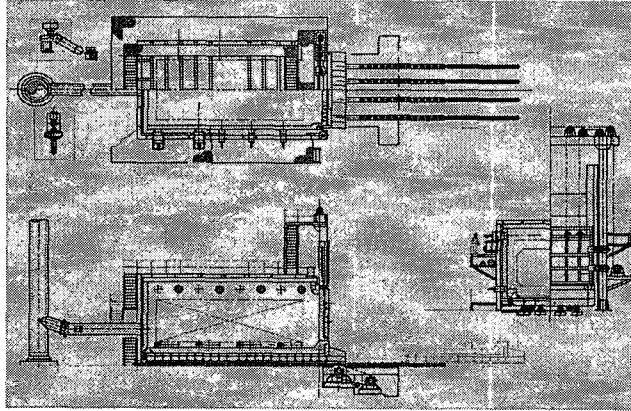
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▣ LAY OUT

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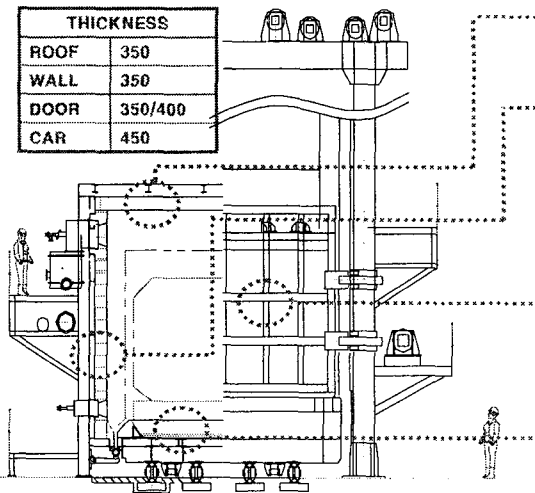
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▣ REFRACTORIES

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THICKNESS	
ROOF	350
WALL	350
DOOR	350/400
CAR	450



C/F Block(1500℃)	300
C/F Blanket	50

Plastic (PT-165)	235
Super Board	65
Silica Board	50

C/F Block(1500℃)	300
C/F Blanket(1260℃)	50
HACT-160	325
INCT	75

Plastic (PT-165)	190
SK34 Firebrick	65
SK32 Firebrick	65
B-2	130
HSC-160	450

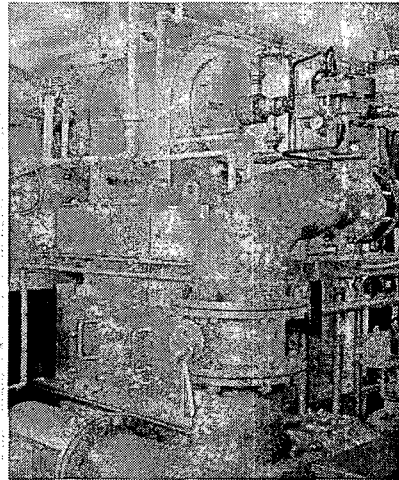
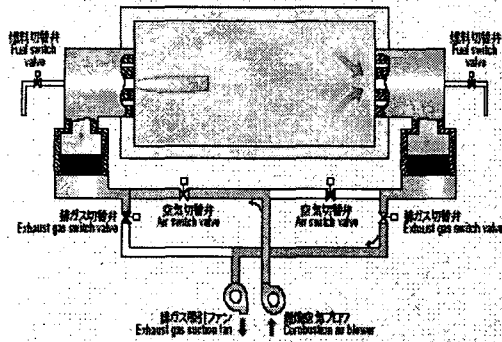
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COMBUSTION SYSTEM I

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BURNER

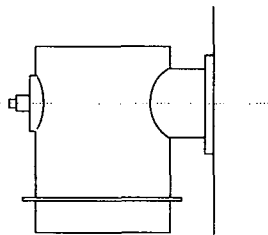
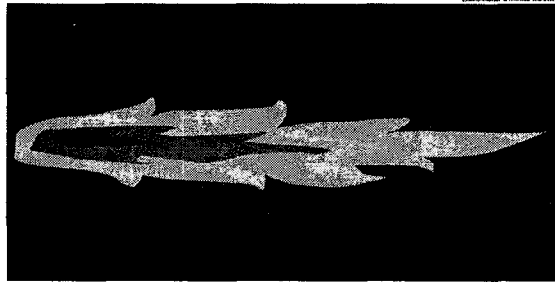
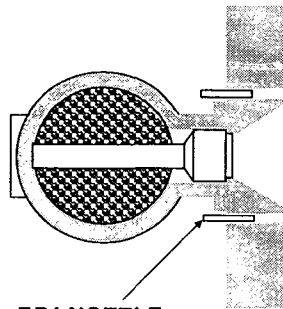


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COMBUSTION SYSTEM II

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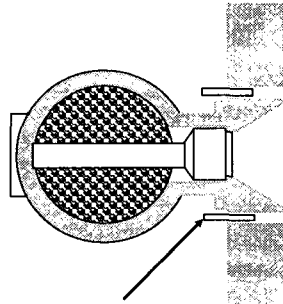
BELOW 900°C PILOT + MAIN BURNER

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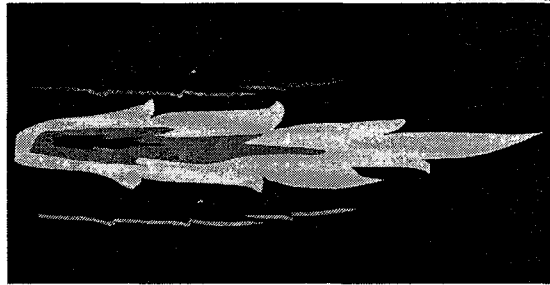
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■ COMBUSTION SYSTEM III

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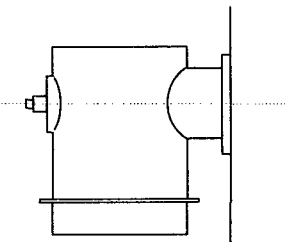


FDI NOZZLE



2EA/BURNER ( 16EA - UPPER WALL)

ABOVE 900°C PILOT + MAIN BURNER  
+FDI NOZZLE



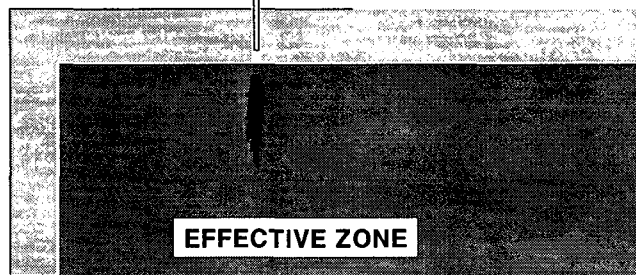
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BOTTOM FDI NOZZLE

FUEL DIRECT INJECT

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EFFECTIVE ZONE

8EA - BOTTOM

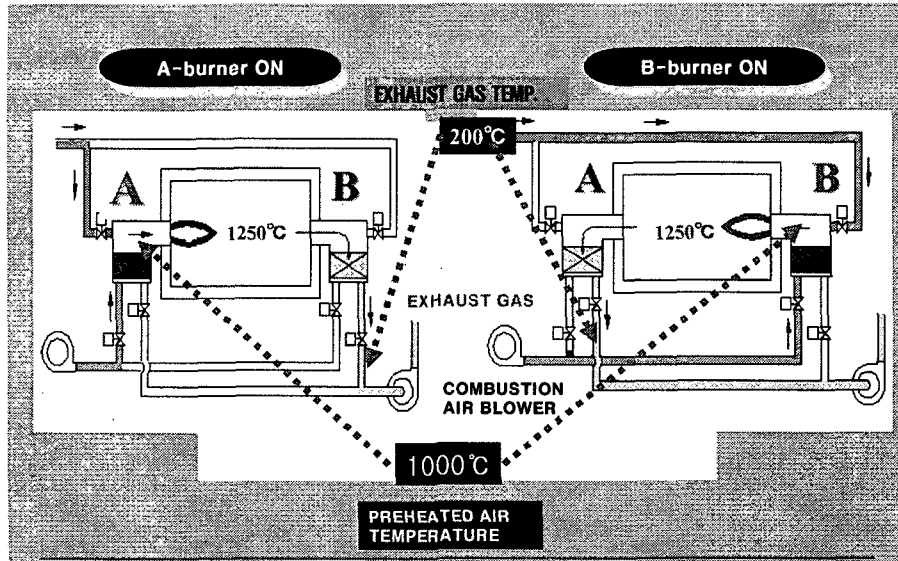
ABOVE 900°C

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## COMBUSTION SEQUENCE

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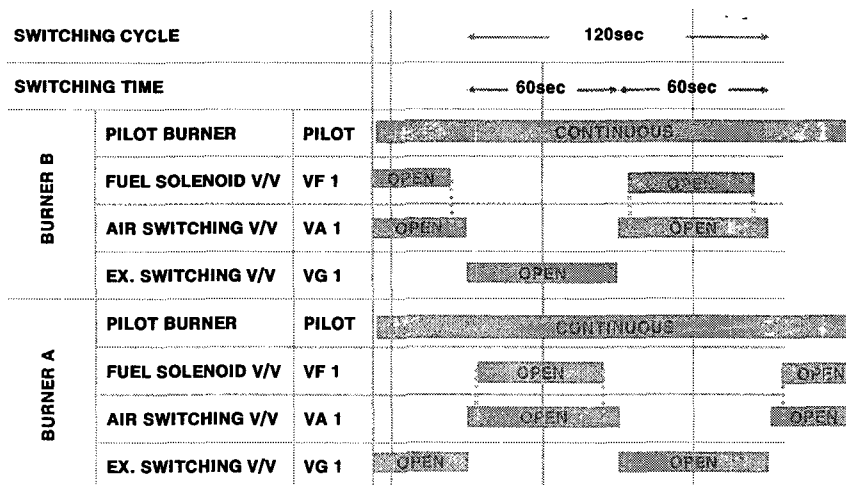
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## SWITCHING CYCLE OF BURNER

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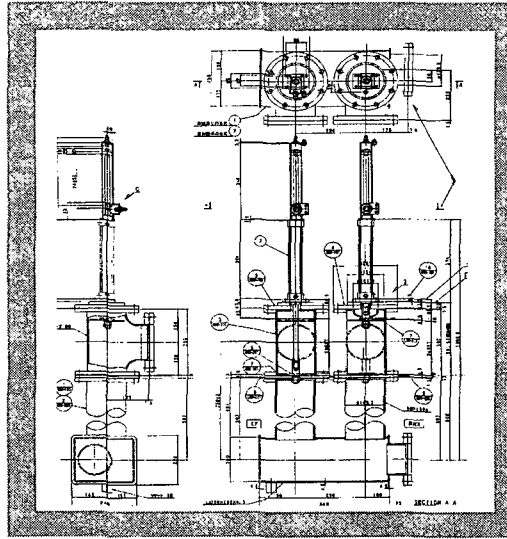
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■ SWITCHING VALVE

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**SIMPLE DESIGN**  
**EASY MAINTENANCE**  
**LONG LIFE TIME**  
**SALES RECORD**  
**(JSW, JCFC, HHI etc)**



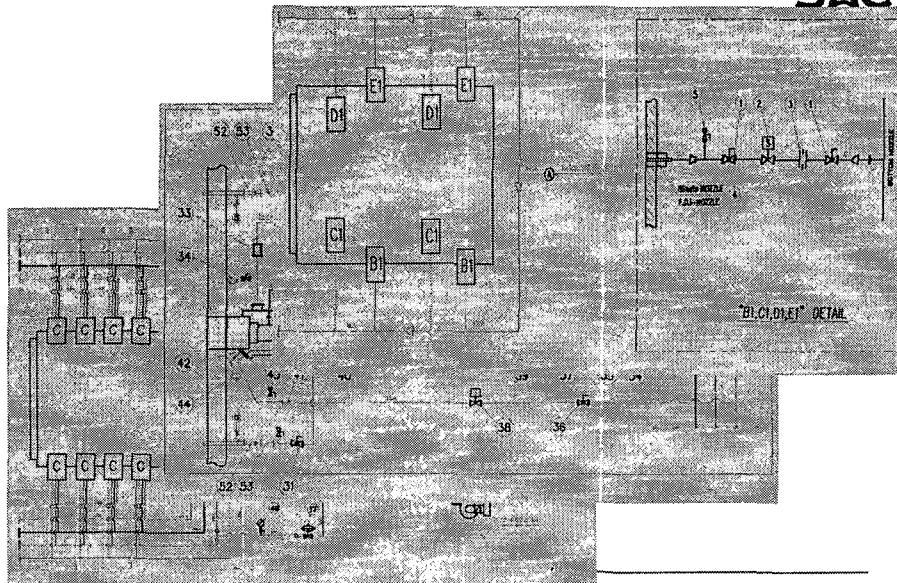
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■ P & ID

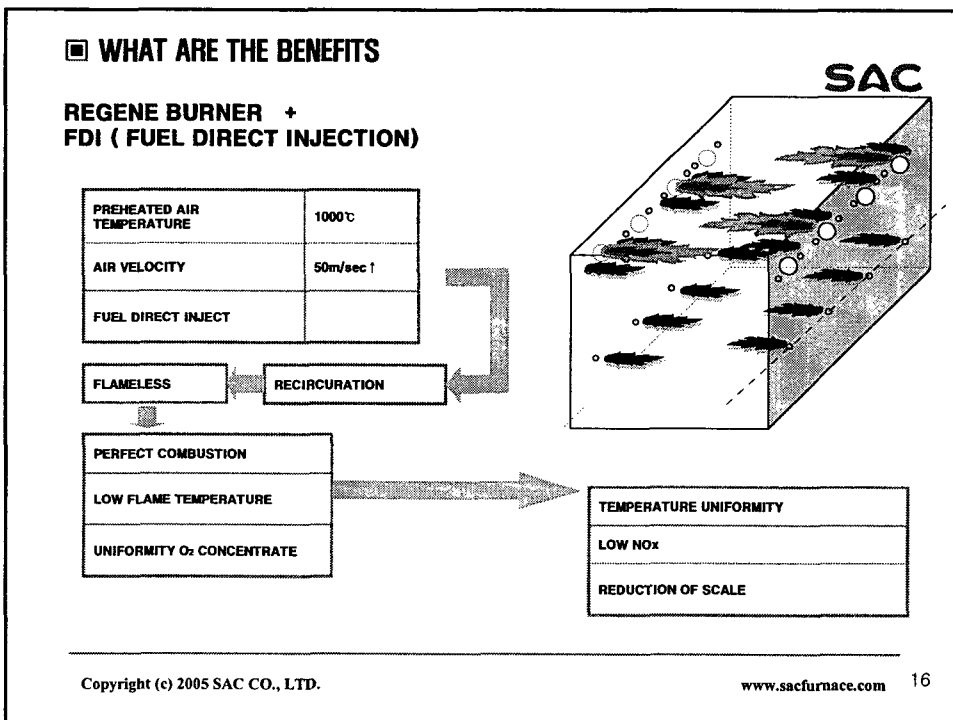
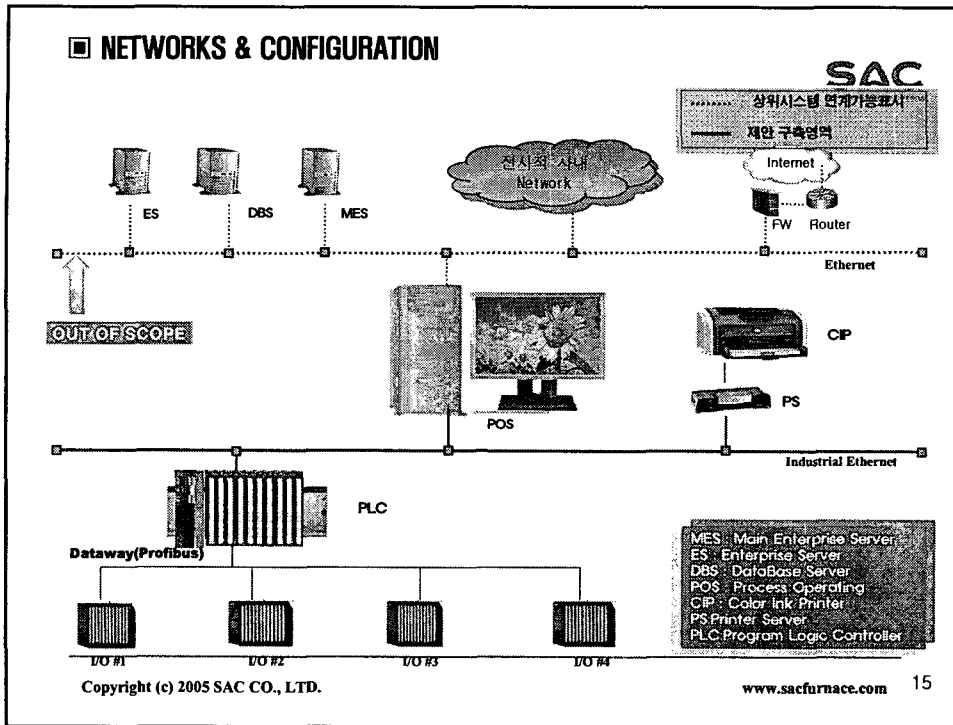
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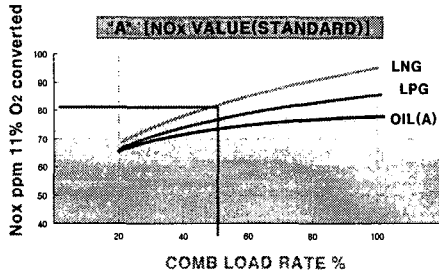
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## REDUCTION OF NOx

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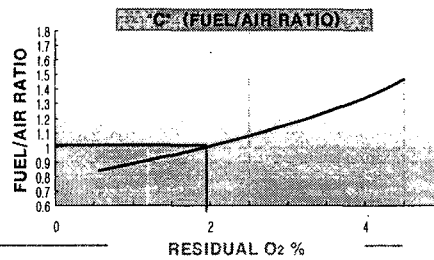
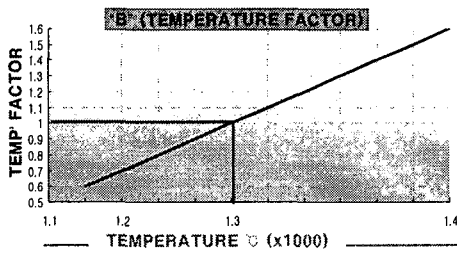


**NOx VALUE**

$$\text{NOx} = A \times B \times C = \text{FUEL NOx}$$

$$= 84 \times 1 \times 1 = 84 \text{ ppm}$$

(Data from Chugai)



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## THERMAL EFFICIENCY

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INPUT (x 10,000 Kcal)		
	A CYCLE	B CYCLE
Calorific value of fuel	10822.7	6289.1
Heat recovery	3529.7	2599.4

	A CYCLE	B CYCLE
THERMAL EFFICIENCY	39.9%	36.1%
COMBUSTION EFFICIENCY	50.9%	38.4%
HEAT STORAGE EFFICIENCY	58.5%	59.1%

A1

A2

- B1: SENSIBLE HEAT OF WORKPIECE
- B2: SENSIBLE HEAT OF SUPPORT
- B3: RADIATION LOSS OF F<sub>ce</sub> PROPER
- B4: HEAT STORAGE OF F<sub>ce</sub> PROPER
- B5: WASTE GAS LOSS
- B6: OTHERS

(B1+B2)/A1

(A1-B5)/A1

A2/(B5+B6)

