CATALYST SELECTION
General information for SRU and TGTU

1. NECESSARY REQUIREMENTS

1.1. TECHNICAL AND ECONOMICAL DATA
The selection of catalysts for the SRU (Sulfur Recovery Unit) and/or TGTU (Tail Gas Treatment Unit) at PETROBRAS refineries will be based on the catalyst cost.

But the final decision will be based on the result of the balance between cost and technical information given by the supplier.

1.1.1. Eliminative Parameters
In order to maintain its qualifying in the present purchasing process, the catalyst bidder must fulfill the following requirements:

- Minimum Catalyst Cycle Length = 48 months;
- Minimum overall sulfur conversion: Claus Unit + TGTU = 99,5%;
- Technical information given by the supplier, in terms of catalyst performance forecast and its characterization and benefits during the catalyst cycle length in the unit and environmental aspects.

1.2. CATALYST QUALITY CERTIFICATION
The selected supplier should send to PETROBRAS the quality certification of the purchased catalyst inventory.

The selected supplier should send to PETROBRAS the reference list.

1.3. CATALYST HANDLING AND OPERATION PROCEDURES
The selected supplier should submit to PETROBRAS the recommended procedures for:

- Loading and unloading;
- Rejuvenation *in situ*;
- Passivation *in situ*;
- Start-up, shutdown and emergency;

Information on the safe handling, storage, disposal and toxicity of materials supplied as may be required by law, such as Material Safety Data Sheets (MSDS).

1.4. TECHNICAL SERVICE SUPPORT
The selected supplier has to meet with the following requirements:

- ✓ at least one technical visit a year to the refinery and to the Company headquarter;

- ✓ at least two catalyst deactivation forecast a year based on unit data.

1.5. INVENTORY

The SRU and/or TGTU inventories are described in the **ANNEX 1**. *(information disclosed to each new bidding process, depending on the requesting units).*

1.5.1. Catalyst Beds Composition - General information

The SRU first reactor catalyst bed of each unit is composited by around 30% of the volume of TiO_2 and second and third reactor catalyst beds are composited only by alumina type catalyst.

For all the reactors, support catalyst is considered at top and bottom, 5% and 10% of the total volume per reactor, respectively.

2. TECHNICAL INFORMATION

2.1. UNIT DATA

The SRU and/or TGTU operational characteristics and unit details are described in the **ANNEX 1** *(information disclosed to each new bidding process, depending on the requesting units).*

The SRU feed composition are described in the **ANNEX 2** for information and use when the supplier considers it necessary. *(information disclosed to each new bidding process, depending on the requesting units).*

The SRU of the refineries will process the feed to overall sulfur conversion requirements ranging from 96% to 98%. For the TGTU catalyst proposal, the supplier shall consider 96% overall sulfur conversion at the respective SRU.

The TGTU will achieve a total sulfur recovery of at least 99,5% with hydrogenation of sulfur elements to H2S form and recycle to SRU after amine absorber process.

2.2. PROPOSED CATALYSTS CHARACTERIZATIONS

Identification
Type
Shape / Nominal Size (mm or inch)
Chemical Composition (% wt. dry base)
BET Surface Area (m^2/g)
Reactor loading density (g/cm^3)

ANNEX 1

SRU Characteristics		**xxxxx**
		xxxxx
Feed Flow Acid Gas	Nm³/h	
Feed Flow NH3 Gas	Nm³/h	
Temperatures:		
Combustion Chamber	(°C)	
Inlet Reactor #1	(°C)	
Outlet Reactor #1	(°C)	
Inlet Reactor #2	(°C)	
Outlet Reactor #2	(°C)	
Inlet Reactor #3	(°C)	
Outlet Reactor #3	(°C)	
Claus Reactor (quant)		
Reactor #1	(m3)	
Reactor #2	(m3)	
Reactor #3	(m3)	
ReHeaters:		
Reheater # 1		
Reheater # 2		
Reheater # 3		
Tail Gas		
TGTU Characteristics		
Temperatures:		
Reactor #1	**(m3)**	
ReHeater type:		
Inlet Temperature Reactor (external hydrogen mode)	(°C)	
Outlet Temperature Reactor (external hydrogen mode)	(°C)	

ANNEX 2

SRU Feed		xxxx
Acid Gas Compos.		xxxx
H_2S	(Vol. %)	
NH_3	(Vol. %)	
CO_2	(Vol. %)	
H_2O	(Vol. %)	
H_2	(Vol. %)	
SO2	(Vol. %)	
CO	(Vol. %)	
COS	(Vol. %)	
CH_4	(Vol. %)	
C_2H_6	(Vol. %)	
C_3H_8	(Vol. %)	
C_4H_{10}	(Vol. %)	
C5H12	(Vol. %	
C_6H_{14}	(Vol. %)	
N_2	(Vol. %)	
BTEX	(Vol. %)	
C2H4	(Vol. %)	
C3H6	(Vol. %)	
i-BUTANO	(Vol. %)	
BUTENO-1	(Vol. %)	
i-BUTENO	(Vol. %)	
C-BUTENO-2	(Vol. %)	
T-BUTENO-2	(Vol. %)	
O2		
TOTAL	(Vol. %)	
NH3 Gas Compos.		
H_2S	(Vol %)	-
NH_3	(Vol %)	-
CO_2	(Vol %)	-
H_2O	(Vol %)	-
TOTAL	(Vol %)	-