

PART IV

DETAILED TERMS AND CONDITIONS OF THE ORDER

regarding:

„Purchase and delivery of burners with top covers and a new catalyst charge for secondary reformers installed at the Ammonia Plant in GA Police”

I. DEFINITIONS

TECHNICAL DOCUMENTATION	BIDDER's/SELLER's data, specifications, drawings, flow diagrams, instructions and all information regarding the design package related to the Subject Matter of the Order.
INSTALLATION or INSTALLATION OF GAS PREPARATION	a synthesis gas preparation installation for the production of ammonia located in the area of Grupa Azoty Zakłady Chemiczne "Police" S.A. in Police, consisting of two separate production lines (line A and line B).
CATALYST	catalyst or catalysts, provided by the Contractor, for the REFORMERS
PALNIK	burner with a top cover for the REFORMER designed by the Seller to be installed in REFORMERS
P&ID	Piping and Instrumentation Diagram
REFORMER(S)	reformer (s) technological no. 11B-302 and/or 12B-302 at the ammonia plant of Grupa Azoty Zakłady Chemiczne "Police" S.A., in Police, Poland, before or after the installation of the SELLER's BURNER under the Subject Matter of the Order, depending on the situation.
TEST RUN	72-hour, failure-free operation of the INSTALLATION to document process guarantees, as described in detail in Annex C of the Draft Agreement, i.e. Part III of the TOR
GOODS	BURNER, CATALYST for REFORMER, TECHNICAL DOCUMENTATION and SITE SERVICES provided by the SELLER for apparatus technological no. 11B-302 and 12B-302
SITE SERVICES	a total number of a maximum of 40 (forty) days of supervising the assembly of burners with top covers, loading, reduction of the catalyst, assembly of burners, start-up and final TEST RUN;
SELLER	The company or companies within the consortium with which the BUYER will sign a Contract for the performance of the Subject Matter of the Order of the TOR.
BUYER or Ordering Party	Grupa Azoty Zakłady Chemiczne „Police” S.A.
BUYER'S AREA	the area of the BUYER's enterprise as well as any other area constituting the BUYER's property or controlled by the BUYER in any other manner, in particular under a contract for perpetual usufruct, hire and/or rent, which are in any case located in Police, Poland.

II. DESCRIPTION OF THE OBJECT OF THE ORDER
2.1. Subject matter of the order

The subject matter of the order is the design, purchase and delivery of two burners with top covers, two charges of a new catalyst for secondary reformers operating in the synthesis gas preparation installation being part of the ammonia production installation and supervision over works carried out on the installation.

The subject matter of the order, in particular, includes the purchase and delivery of GOODS, preparation of TECHNICAL DOCUMENTATION along with obtaining arrangements and approvals of documentation with the Office of Technical Inspection and SITE SERVICES.

2.2. General description
2.2.1. Hydrogen stream from propylene production installation

Grupa Azoty Polyolefins S.A. is building an integrated complex consisting of a propane dehydrogenation to propylene (PDH) installation and a polypropylene production installation. **The by-product of the PDH installation will be a pure hydrogen stream, which is to be managed in the Ammonia Plant of Grupa Azoty "Police" S.A.**

All the following variants of operation of the ammonia production installation should be taken into account in relation to the scope of necessary modernization changes:

- Base Variant: Normal operation of ammonia production plant without addition of hydrogen stream from PDH production plant,
- Variant I: managing of the whole hydrogen stream from PDH plant (2015 kg H₂/h) in two ammonia production lines, that is 1007,5 kg H₂/h for each line,
- Variant II: managing of the whole hydrogen stream from PDH plant (2015 kg H₂/h) in one ammonia production line.

2.2.2. Ammonia production plant

The ammonia production technology used by Grupa Azoty Zakłady Chemiczne "Police" S.A. it is based on two-stage steam reforming of natural gas with a stoichiometric amount of process air, two-stage conversion of carbon monoxide, Benfield CO₂ removal, methanation and catalytic ammonia synthesis with synthesis gas recirculation. The plant was designed under a license from Haldor Topsøe and commissioned in 1984. It consists of two identical production lines, each of which has been designed for a capacity of 750 MTPD. In previous years, the installation was modernized and currently its production capacity is 2 x 930 MTPD (max. 2 x 950 MTPD)

2.3. Guidelines for the modernization of Secondary Reformer 11/12B302

After the integration of the hydrogen stream from PDH, both ammonia production lines will have to be adapted to both the parameters of operation with a variable supply of the hydrogen stream (Variant I and II) and to the parameters of operation under the base conditions, i.e. without the hydrogen stream from the PDH.

The 11/12 B302 secondary reforming reactor will have to be adapted to work in a wide variety of conditions, parameters and technological loads. In the absence of hydrogen supply from PDH, the apparatus will operate within the parameters normally expected for the production loads of 850 to 950 MTPD. It should be noted that the nominal load of the line is 930 MTPD, and production installations are most often operated with this load.

After introducing the hydrogen stream from the PDH installation, the operating conditions of the reformer 11 / 12B302 will change significantly. For a given production level, the amount of technological air must remain at the level of the balance nitrogen demand for ammonia synthesis. On the other hand, the production of hydrogen from natural gas and steam must be reduced by the amount of hydrogen supplied to the installation for the production of ammonia from PDH. After the addition of the hydrogen stream, the synthesis gas upstream of the synthesis reactor should reach a ratio of H₂: N₂ = 3: 1.

The burner and top cover of the secondary reformer must operate properly in the full range of operating parameters.

2.4. Guidelines for the selection of burner and new top cover for the secondary reformer 11/12B302 (line A and B).

The guidelines for the ranges of the burner operating parameters and the parameters of gas streams are presented below.

Table 1. Parameters range for both inlet streams in which the burner has to operate stably and efficiently. The table also shows the maximum allowable parameter values arising from safety measures used on installation, i.e. safety interlocks, alarms and safety valves setpoints, etc.

- Table 2. Summary of parameters for **minimum** expected load of ammonia production installation - 850 MTPD of ammonia at maximum H₂O/C ratio of 3,6 mol/mol at the inlet to the primary reformer.
- Table 3. Summary of parameters for **maximum** expected load of ammonia production installation - 950 MTPD of ammonia at maximum H₂O/C ratio of 3,6 mol/mol at the inlet to the primary reformer.
- Table 4. Summary of parameters for **nominal** expected load of ammonia production installation - 930 MTPD of ammonia at H₂O/C ratio of 3,35 mol/mol at the inlet to the primary reformer, i.e. expected for operation in base conditions without integration of hydrogen stream from PDH.
- Table 5. Summary of parameters for nominal load of ammonia production installation - 930 MTPD of ammonia at H₂O/C ratio of 3,35 mol/mol at the inlet to the primary reformer and integration of 11200 Nm³/h (1007,5 kg/h) of hydrogen from PDH on one ammonia production line - Variant I
- Table 6. Summary of parameters for nominal load of ammonia production installation - 930 MTPD of ammonia at H₂O/C ratio of 3,55 mol/mol at the inlet to the primary reformer and integration of 22400 Nm³/h (2015 kg/h) of hydrogen from PDH on one ammonia production line - Variant II

Table 1. Parameters range for secondary reformer 11/12B302 inlet streams.

Parameter		unit	Process air and steam	Process gas (inlet)
Working temperature	minimum	°C	420	720
	maximum		520	780
Temperature	Maximum allowable	°C	565	800
Working pressure	minimum	MPa(g)	3.15	2.90
	maximum	MPa(g)	3.35	3.10
Pressure	Maximum allowable	MPa(g)	3,63	3,63
Working flow	minimum	Nm ³ /h	31 200 + 2500	100 000
	maximum	Nm ³ /h	34 500 + 4400	143 000
Flow	Maximum allowable	Nm ³ /h	36 500 + 4 500	145 000

Table 2. Secondary reformer stream parameters - 850 t/d ($H_2O/C = 3,60$).

Item	Unit	Air + steam	Process gas (inlet)	Process gas (outlet)	
Composition	H ₂	0,00	68,68	56,16	
	CO	0,00	8,15	11,87	
	CO ₂	0,04	10,98	8,16	
	CH ₄	0,00	11,72	0,35	
	N ₂	% volume (dry gas)	78,08	0,47	23,14
	Ar		0,93	0,01	0,28
	O ₂		20,95	0,00	0,00
	Sum for dry gas		100,00	100,00	100,00
	H ₂ O		7,98	80,93	59,77
Volume flow	Dry gas	31 195 1392	70,475 3144	106 668 4759	
	H ₂ O	Nm ³ /h kmol/h	2488 111	57 038 2545	
	Wet gas		33 683 1503	127 512 5689	
Mass flow	Dry gas	kg/h	40 314	33 055	
	H ₂ O		2000	45 845	
	Wet gas		42 314	78 900	
Temperature	°C	520	773	956	
Pressure	MPa (g)	3,18	2,94	2,93	
Molar mass	kg/kmol	28,16	13,87	15,94	
Density	kg/m ³	13,90	4,839	4,716	
Specific capacity	heat	kJ/kg/°C	1,1516	2,9084	
		kJ/kmol/°C	32,424	40,336	
			2,3887	38,081	

Table 3. Secondary reformer stream parameters - 950 t/d ($H_2O/C = 3,60$).

Item	Unit	Air + steam	Process gas (inlet)	Process gas (outlet)	
Compos ition	H ₂		0,00	68,48	56,14
	CO		0,00	8,08	11,87
	CO ₂		0,04	10,99	8,17
	CH ₄		0,00	11,98	0,39
	N ₂	% volume (dry gas)	78,08	0,45	23,16
	Ar		0,93	0,01	0,28
	O ₂		20,95	0,00	0,00
	Sum for dry gas		100,00	100,00	100,00
	H ₂ O		7,13	81,74	59,66
Volume flow	Dry gas		34 902 1557	78 354 3496	119 208 5318
	H ₂ O	Nm ³ /h kmol/h	2488 111	64 044 2857	71 119 3173
	Wet gas		37 390 1668	142 398 6353	190 327 8491
Mass flow	Dry gas		45 104	36 826	78 245
	H ₂ O	kg/h	2000	51 476	57 162
	Wet gas		47 104	88 302	135 407
Temperature	°C	520	774	955	
Pressure	MPa (g)	3,34	3,07	3,06	
Molar mass	kg/kmol	28,24	13,90	15,95	
Density	kg/m ³	14,62	5,049	4,913	
Specific capacity	heat				
		kJ/kg/°C	1,1466	2,9085	2,3884
		kJ/kmol/°C	32,377	40,426	38,086

Table 4. Secondary reformer stream parameters - base variant 930 t/d ($H_2O/C = 3,35$).

Item	Unit	Air + steam	Process gas (inlet)	Process gas (outlet)	
Compos ition	H ₂		0,00	67,27	55,77
	CO		0,00	7,92	11,95
	CO ₂		0,04	11,32	8,35
	CH ₄		0,00	13,33	0,64
	N ₂	% volume (dry gas)	78,08	0,16	23,03
	Ar		0,93	0,00	0,27
	O ₂		20,95	0,00	0,00
	Sum for dry gas		100,00	100,00	100,00
	H ₂ O		9,07	78,58	56,44
Volume flow	Dry gas		34 302 1530	75 ,039 3348	116 824 5212
	H ₂ O	Nm ³ /h kmol/h	3110 139	58 966 2631	65 933 2942
	Wet gas		37 412 1669	134 005 5979	182 758 8154
Mass flow	Dry gas		44 330	35 951	77 181
	H ₂ O	kg/h	2500	47 395	52 995
	Wet gas		46 830	83 346	130 175
Temperature	°C	505	755	930	
Pressure	MPa (g)	3,19	2,92	2,91	
Molar mass	kg/kmol	28,06	13,94	15,97	
Density	kg/m ³	14,17	4,915	4,785	
Specific capacity	heat				
		kJ/kg/°C	1,1546	2,9053	2,3733
		kJ/kmol/°C	32,393	40,508	37,889

Table 5. Secondary reformer stream parameters - 930 MTPD, Variant I ($H_2O/C = 3,35$).

Item	Unit	Air + steam	Process gas (inlet)	Process gas (outlet)	
Compos ition	H ₂	0,00	66,52	53,58	
	CO	0,00	7,43	11,83	
	CO ₂	0,04	11,50	8,23	
	CH ₄	0,00	14,38	0,38	
	N ₂	% volume (dry gas)	78,08	0,17	25,67
	Ar		0,93	0,00	0,31
	O ₂		20,95	0,00	0,00
	Sum for dry gas		100,00	100,00	100,00
	H ₂ O		9,21	81,10	56,87
Volume flow	Dry gas	33 771 1507	63 255 2822	103 113 4601	
	H ₂ O	Nm ³ /h kmol/h	3110 139	51 297 2289	
	Wet gas		36 881 1645	114 552 5111	
Mass flow	Dry gas	kg/h	43 643	30 585	
	H ₂ O		2500	41 231	
	Wet gas		46 143	71 815	
Temperature	°C	465	746	950	
Pressure	MPa (g)	3,19	2,91	2,90	
Molar mass	kg/kmol	28,04	14,05	16,34	
Density	kg/m ³	14,93	4,983	4,807	
Specific capacity	heat				
		kJ/kg/°C	1,1460	2,8946	2,3243
		kJ/kmol/°C	32,136	40,674	37,987

Table 6. Secondary reformer stream parameters - 930 MTPD, Variant II ($H_2O/C = 3,55$).

Item	Unit	Air + steam	Process gas (inlet)	Process gas (outlet)	
Compos ition	H ₂	0,00	65,67	50,74	
	CO	0,00	6,42	11,14	
	CO ₂	0,04	12,04	8,49	
	CH ₄	0,00	15,67	0,18	
	N ₂	% volume (dry gas)	78,08	0,19	29,10
	Ar		0,93	0,00	0,35
	O ₂		20,95	0,00	0,00
	Sum for dry gas		100,00	100,00	100,00
	H ₂ O		12,63	90,13	62,11
Volume flow	Dry gas	34 470 1538	53 833 2402	92 838 4142	
	H ₂ O	Nm ³ /h kmol/h	4355 194	48 519 2165	57 661 2573
	Wet gas		38 825 1732	102 353 4566	150 499 6715
Mass flow	Dry gas	kg/h	44 546	26 398	67 097
	H ₂ O		3500	38 998	46 345
	Wet gas		48 046	65 396	113 442
Temperature	°C	430	728	970	
Pressure	MPa (g)	3,19	2,90	2,89	
Molar mass	kg/kmol	27,74	14,32	16,89	
Density	kg/m ³	15,52	5,158	4,876	
Specific capacity	heat	kJ/kg/°C	1,1577	2,8530	2,2702
		kJ/kmol/°C	32,111	40,857	38,354

2.5. Scope for the performance of the technical documentation.

2.5.1. General scope.

- 2.5.1.1. The technical parameters of the existing INSTALLATION, necessary for the design, will be provided to the SELLER by the BUYER after signing the Contract for the implementation of the Subject Matter of the Order of this TOR. They will be furnished by BUYER at no cost and within the shortest possible time.
- 2.5.1.2. All SELLER engineering deliverables and other documents shall be written in the English language.
- 2.5.1.3. The units of measure for engineering shall be in accordance to the metric system apart from temperature which shall be in °C.
- 2.5.1.4. The size, scale and numbering system of drawings and other documents shall be as per SELLER's standards.
- 2.5.1.5. SELLER shall furnish to BUYER the drawings and documents in 3 (three) copies + PDF electronic version.

2.5.2. SCOPE OF SUPPLY OF THE TECHNICAL DOCUMENTATION

- 2.5.2.1. Secondary reformer Material and Heat balances.
- 2.5.2.2. Process Description after revamping, with new elements.
- 2.5.2.3. Process flow diagram.
- 2.5.2.4. Modification of existing PI&D around the REFORMER (marking up of existing PI&D is recommended).
- 2.5.2.5. BURNER Process Specification.
- 2.5.2.6. Catalyst and inert material specification.
- 2.5.2.7. Suitability assessment of existing secondary reformers equipment to the new operating conditions after retrofit.
- 2.5.2.8. Making arrangements and approval of design documentation with Office of Technical Inspection in Poland (UDT).
- 2.5.2.9. Preparation of documentation for all flange connections with indication of optimum and maximum values of bolt tightening torques that ensure tightness of connections according to standard EN PN 1591.
- 2.5.2.10. Design and manufacturing of the BURNER must be performed based on applicable standards (e.g. ASME VIII Div.1, standards harmonized with the Pressure equipment Directive 2014/68/UE PED, etc.). Requirements for the standards and regulations shall be agreed with Office of Technical Inspection in Poland.
- 2.5.2.11. BURNER Installation Drawings
- 2.5.2.12. BURNER Installation Procedure
- 2.5.2.13. List of Main Tools and Equipment for Performing Installation Work.
- 2.5.2.14. List of Recommended Spare Parts.
- 2.5.2.15. Catalyst and inert material unloading and loading procedures.
- 2.5.2.16. List of main tools and equipment for performing catalyst and inert material unloading and loading.
- 2.5.2.17. Operating manual (revision of the existing one) including Start-up and Shut-down Procedure.
- 2.5.2.18. Catalyst reduction procedure.
- 2.5.2.19. Specification for storage of BURNER at BUYER's AREA.
- 2.5.2.20. Analysis and confirmation, that operating parameters of the REFORMER with new BURNER and CATALYST will not exceed allowable working parameters of the REFORMER. REFORMER with the new BURNER and CATALYST shall not change the loads of on existing structure and fundaments.
- 2.5.2.21. Inspection and certificates of pressure tests.
- 2.5.2.22. Calculation of possible maximum temperature at REFORMER's outlet pipeline. The temperature must be below 1000 °C.

2.6. Scope of delivery of equipment and materials

- 2.6.1. Materials and elements used to manufacture the BURNER must be new and bear the CE marking (if required).
- 2.6.2. For the materials used for manufacturing, fasteners (bolts, nuts), gaskets an acceptance certificate 3.2 according to EN 10204 is required. Threads shall be manufactured with rolling method also confirmed with acceptance certificate 3.2 and must be permanently marked.
- 2.6.3. The outer surface of BURNER's top cover shall be protected against corrosion for the category of corrosive atmosphere C5-I very high (industry) acc. EN ISO 12944-2 (paint selected for design temperature conditions of the top cover of the apparatus).
- 2.6.4. Supply of the BURNER and CATALYST for secondary reformer includes:
 - 2.6.4.1. 2 (two) new BURNER's, for revamping the existing REFORMERS of the INSTALLATION according to SELLER design engineered for the conditions set out in point 2.4. above.
 - 2.6.4.2. 2 (two) charges of catalyst. Expected catalyst lifetime is 10 (ten) years.
- 2.6.5. The technical and technological requirements for the Catalyst referred to above are included in point 2.10.
- 2.6.6. The Bidder will provide information on the number and types of the proposed catalyst beds and their quantity and sizes of catalyst elements (rings, multi-hole rings).
- 2.6.7. The delivery of the CATALYST referred to in point 2.6.4.2 also includes the delivery of inert material such as corundum fittings or balls under and on the catalyst bed supporting the catalyst bed and protection against direct exposure to the flame. The amount of inert material is to be selected by the Bidder and is to ensure the correct and safe operation of the REFORMERS and INSTALLATION. The Bidder in the offer will provide information on the quantity, type and characteristics of the inert material.
- 2.6.8. The delivery of the BURNER and the CATALYST will be performed under the terms of DDP INSTALLATION ON BUYER'S AREA.
- 2.6.9. Spare Parts for installation of BURNER. The following spare parts will be included in the supplied materials:
 - 2.6.9.1. 10% (ten percent) of bolts, nuts and washers,
 - 2.6.9.2. 3 (three) complete sets of gaskets,
- 2.6.10. Deliveries, shipping services, packaging, marking and transport:
 - 2.6.10.1. The SELLER will provide deliveries, shipping services for the equipment and materials provided by the SELLER in accordance with the above clauses 2.6.1 to 2.6.9, according to the standard procedures of the SELLER and through the SELLER's personnel.
 - 2.6.10.2. Equipment and materials will be properly packed and labeled in accordance with the SELLER'S standards. The packaging should be suitable for long-term storage and long-distance transport.
 - 2.6.10.3. The SELLER will arrange the transport of the delivered devices and materials on the basis of DDP. INSTALLATION ON THE BUYER'S AREA.
 - 2.6.10.4. Shipping insurance will be arranged by the SELLER in accordance with the INCOTERMS.
- 2.6.11. Inspection at the Seller.
 - 2.6.11.1. SELLER shall grant to BUYER, if requested, the free access to SELLER's/Subcontractors workshops in order to carry out the inspection work, together with the SELLER's inspectors, pertaining to the BURNERS to be supplied by SELLER under this Contract.
 - 2.6.11.2. The detailed program for the inspection works will be decided in advance by the representatives of both parties through consultation. SELLER shall provide all necessary co-operation and assistance in this regard. BUYER shall bear all costs of their personnel taking part in the inspections.

2.7. Site services.

- 2.7.1. SELLER shall depute to the BUYER'S AREA its experienced, skilled and competent technical personnel to provide assistance and supervision services during the following phases:
 - 2.7.1.1. installation works for BURNERS,
 - 2.7.1.2. catalyst loading,
 - 2.7.1.3. REFORMERS commissioning,
 - 2.7.1.4. catalyst reduction,
 - 2.7.1.5. BUYER's operator training,
 - 2.7.1.6. TEST RUN and operating parameters optimisation.
- 2.7.2. Abovementioned services are mandatory to keep valid the performance guarantees given by SELLER.
- 2.7.3. The exact time of arrival at and departure from BUYER'S AREA of the SELLER's technical personnel will be decided by the representatives of both parties through consultation.
- 2.7.4. Upon BUYER's request, SELLER will provide services other than the technical site services described above, for which the same conditions as specified in this TOR will apply.
- 2.7.5. The period of 40 (forty) days of SITE SERVICES will be included in the lump-sum remuneration for the performance of the Subject of the Order of this TOR.
- 2.7.6. All SITE SERVICES provided by SELLER exceeding the total amount of 40 (forty) days already included in the total lump sum remuneration shall be remunerated by BUYER. However, the aforementioned amount of 40 (forty) days shall not include the presence of SELLER's specialists in Police, Poland due to reasons attributable to the SELLER (i.e. additional test runs, stand-by time caused by the SELLER, etc.).
- 2.7.7. The additional remuneration, referred to in point 2.7.6 above, shall be settled in accordance with the following conditions:
 - 2.7.7.1. For SITE SERVICES provided by the SELLER during installation, commissioning, start-up and test operation, the daily rate will be applied in the amount indicated by the Bidder in Annex 6 Trade Offer / List of Prices, item 3 List of Prices constituting an appendix to TOR.
 - 2.7.7.2. This rate includes all travel, living and lodging expenses. The rate is applicable to every day of presence at BUYER's AREA.
 - 2.7.7.3. The same rate shall also be applied to stand-by time of SELLER's personnel during works at BUYER's AREA in case this was caused through no fault by SELLER.
 - 2.7.7.4. The BUYER will pay for the SITE SERVICES within 30 days after receiving the relevant invoice, on the basis of the works acceptance protocol.

2.8. Copyright.

- 2.8.1. Detailed provisions of intellectual property rights, patents, licenses and other similar rights can be found in the Draft Agreement forming part III of the Terms of Reference.
- 2.8.2. The SELLER shall be fully liable towards the third parties for any possible violation of their intellectual property rights, patent rights and other similar rights that may occur during and/or in connection with the performance of the Subject Matter of the Order of this Terms of Reference.
- 2.8.3. The SELLER undertakes to grant to the BUYER - within the lump-sum remuneration indicated in Annex 6 - the Commercial Offer/Price List point 1 annexed to the TOR unlimited right to use the TECHNICAL DOCUMENTATION.

2.9. Test Run and Process Guarantees

- 2.9.1. Detailed provisions concerning the Test Run and the Process Guarantee can be found in the Draft Agreement forming part III of the ToR.
- 2.9.2. The BUYER assumes that a Test Run will be carried out in order to verify the BURNER and CATALYST's ability to meet the Process Guarantees. The Test Run will be conducted by the BUYER under the supervision of the SELLER.

2.9.3. The BUYER requires that the INSTALLATION as a result of a TEST RUN meets the following process guarantees:

2.9.3.1. Guaranteed maximum methane concentration at the outlet of the secondary reformer:

Item	unit	base	V. 1	V. 2
Guaranteed CH ₄ concentration at the outlet of the secondary reformer	[% mol]	0,64	0,38	0,18

2.9.3.2. Guaranteed pressure drop on the secondary reformer. The Bidder will provide the values of the guaranteed maximum pressure drop on the secondary reformer for the conditions of the Base Variant, Variant I and Variant II.

2.10. CATALYST

2.10.1. Technical data:

- 2.10.1.1. Application : Secondary Reformer
- 2.10.1.2. Composition: NiO₂ 10÷12%, Al₂O₃ filling up to 100%
- 2.10.1.3. Form: rings, multi-hole rings
- 2.10.1.4. Density: 0,8÷1,1 (kg/dm³)
- 2.10.1.5. Heat stability (maximum) 1300°C
- 2.10.1.6. Preliminary catalyst volumes (for each reformer): 19,5 m³.
- 2.10.1.7. Methane concentration at the outlet of secondary reformer as in pt. 2.9.3.1.

2.10.2. The Bidder will specify the number of catalyst layers, the type/types of the catalyst, the size of the catalyst and the amounts of the different types of catalyst.

2.10.3. The Bidder will present the physico-chemical properties and operating parameters of the proposed catalysts in the submitted offer.

2.11. Exclusions.

2.11.1. The following materials and/or activities are excluded from the scope of the SELLER's work and will be delivered, carried out or performed directly by the BUYER, without requesting fees from the SELLER:

- 2.11.1.1. Obtaining the necessary approvals, clearances, permits, licenses and legal required approvals required for the project by the state, government and regulatory bodies.
- 2.11.1.2. Covered warehouse for equipment, materials and catalyst supplied by SELLER.
- 2.11.1.3. Qualified personnel, supervision ,equipment, tools and consumables for all works to be performed at BUYER'S AREA, such as, for instance, plant shut down, piping disconnection, blinding, purging, REFORMERS opening and boxing up, removal of old burner and catalyst, installation of new burner, connection of new thermocouples, fresh catalyst loading, etc.,
- 2.11.1.4. Operating safety devices to meet INSTALLATION safety requirements.
- 2.11.1.5. REFORMER tests,
- 2.11.1.6. Assistance in obtaining work permits for SELLER personnel, working IN THE BUYER'S AREA.

2.11.2. Guidelines regarding temperature in the stream mixing (combustion) zone
 Due to the durability of refractory lining, protective layer above the catalyst and nickel catalyst the temperature in the whole mixing zone cannot exceed 1300°C.