

**ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE  
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH**

Laboratoire Européen pour la Physique des Particules  
European Laboratory for Particle Physics

**EDMS No.: 549196 v.1**

**Group code: TS/CV**

**INVITATION TO TENDER**

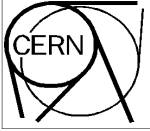
**IT - 3307 / TS / LHCb**

# **SUPPLY AND INSTALLATION OF WATER COOLING EQUIPMENT FOR THE LHCb DETECTOR**

## **Annex A : Unit Price List**

**All prices shall be given in Swiss Francs (CHF), net and firm.**

The prices in this chapter shall correspond to equipment that is supplied and fitted.



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Laboratoire Européen pour la Physique des Particules  
European Laboratory for Particle Physics

**BIDDER'S NAME : INEO ALPES**

CHAPTERS

**PART A: UNIT PRICES**

- A1** HYDRAULIC AND MECHANICAL
- A2** INSTRUMENTATION
- A3** CONTROL
- A4** ELECTRICITY

**PART B: WORK LOTS PRICES**

- WL\_1** Hydraulic and mechanical works for Outer Tracker cooling system
- WL\_2** Control works for OT cooling system
- WL\_3** Electricity works for OT cooling system
- WL\_4** Hydraulic and mechanical works for primary system

**ADJUDICATION FORMULA**

**All prices shall be given in Swiss Francs (CHF), net and firm.**

The prices in this chapter shall correspond to equipment that is supplied and fitted.

To fill in and join to the tender form

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PLACE, DATE, STAMP AND SIGNATURE

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**PART A: UNIT PRICES - HYDRAULIC AND MECHANICAL**

The bidder shall fill all the light blue cells of this document.

All prices have to be considered for equipment completely installed.

Unitary price will be used for any minor modification

(\*) In case different sizings of the same item are used, each one shall be separately priced

Item	Position	Equipment Name	Unit	Total Units	Unit Price [CHF]	Total Price [CHF]	
<b>OUER TRACKER COOLING UNIT - PRIMARY SYSTEM</b>							
1	VALVES	Schrader valve	U	14	167.2	2340	
2		Relief valve	U	16	694.2	11107	
3		Pneumatic shut-off valve normally open 1"	U	2	678.0	1356	
4		Pneumatic shut-off valve normally open 1"1/2	U	1	808.0	808	
5		Pneumatic shut-off valve normally open 2"	U	2	933.4	1867	
6		Pneumatic shut-off valve normally close 3/4"	U	2	473.6	947	
7		Pneumatic shut-off valve normally close 2"	U	2	933.4	1867	
8		Electrical actuated three-ways valve	U	1	1335.0	1335	
9		Shut off manual valve 3/4"	U	14	459.7	6436	
10		Shut off manual valve with open/close switch 2"	U	3	647.8	1943	
11		Manual balancing valve 3/4"	U	13	661.7	8602	
12		Manual balancing valve 1"	U	1	743.3	743	
13		Electrical two-ways regulating valve	U	1	1218.9	1219	
14	MECHANICAL COMPONENTS	Pump CRN 10/5 2,2 kW 11m3/h ; 37 mWs	U	2	3784.5	7569	
15		Demineralization cartridge	U	1	6593.9	6594	
16		Tank 500 liters	U	1	3635.0	3635	
17		Vacuum pump (Installation only)	U	1	300.0	300	
18		Heat exchanger	U	1	2820.3	2820	
19	COMPRESSED AIR LINE	In line mechanical filter	U	1	882.3	882	
20		Manifold for air distribution	U	1	301.8	302	
21		Electrical shut off valve	U	1	394.7	395	
22		Manual regulator, manometer and filter upstream the electro-valves	U	1	510.8	511	
23	Electro-valve for pneumatic valves supply	m	9	452.8	4075		
24	PIPING	Flexible hose	m	4	435.0	1740	
25		Stainless steel pipe PN16 3/4" 304L	m	6	97.4	584	
26		Stainless steel pipe PN16 2" 304L	m	12	152.1	1825	
27	Stainless steel pipe PN16 1"1/2 304L	m	6	126.0	756		
28	OTHERS	Support for piping	U	1	1361.1	1361	
29		Flange	U	4	173.5	694	
30		Collar	U	10	80.1	801	
31		Metallic frame for cooling station	U	1	1894.8	1895	
32	ACCESSORIES	Joints, Bolts, Connexion ...	Ass	1	2001.6	2002	
33		.....			0.0	0	
<b>OTcs</b>	Outer Tracker cooling station - Sum of total prices (CHF)						79312

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### PART A: UNIT PRICES - INSTRUMENTATION

The Bidder shall fill all the light blue cells of this document.  
All prices have to be considered for equipment completely installed.  
Unitary price will be used for any minor modification

Item	Unit	Unit Price (1) [CHF]	Unit	Unit Price of connection, marking, tuning and testing [CHF]
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<b>On/off detectors, analog sensors and transmitters</b>				
Pressure switch	U	413.77	U	68.89
Differential pressure switch	U	1308.06	U	68.89
Flow rate switch	U	608.65	U	68.89
Temperature switch	U	257.11	U	68.89
Pressure transmitter	U	555.26	U	68.89
Flow transmitter	U	2047.51	U	68.89
Temperature sensor type Pt100 for use in non-the protected zone	U	360.38	U	68.89
Temperature sensor type Pt100 with integrated transmitter (4-20 mA output)	U	451.15	U	68.89
Conductivity transmitter	U	2528.03		68.89
...		0.00		0.00
...		0.00		0.00
(1) Supply and installation				
<i>The Bidder shall give a list of all the components (indication of the make and reference)</i>				

Item	Unit	Unit Price (1) [CHF]	Unit	Unit Price of connection, marking, tuning and testing [CHF]
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<b>Local indicators</b>				
Pressure indicator	U	226.91	U	68.89
...				
...				
...				
(1) Supply and installation				
<i>The Bidder shall give a list of all the components (indication of the make and reference)</i>				

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### PART A: UNIT PRICES - CONTROL

The Bidder shall fill all the light blue cells of this document.  
All prices have to be considered for equipment completely installed.  
Unitary price will be used for any minor modification

Item	Reference	Unit	Unit Price (1) [CHF]
<b>PLC</b>			
Power supply module 24 Vdc	TSX PSY 3610M	U	560.63
CPU module Schneider (TSXP57353M)	TSX P57 353M	U	3823.59
Ethernet module (ESY 210)	TSX ETY 210	U	3783.77
Binary inputs module 24 Vdc 16 channels (DEY)	TSX DEY 16D2	U	851.39
Binary outputs module 24 Vdc 8 channels (DSY)	TSX DSY 08T2	U	743.11
Analog inputs module 8 isolated channels (AEY)	TSX AEY 800	U	1962.08
Analog inputs module 4 isolated channels for PT100 connection 4 wires	TSX AEY 414	U	3363.39
Analog outputs module 4 Isolated Channel (ASY)	TSX ASY 410	U	1051.06
Racks 12 emplacements	TSX RKY 12EX	U	1126.86
Câble de chainage	TSX CBY 010K	U	70.02
Terminaisons	TSX TLY EX	U	61.40
<i>(1) Supply and installation</i>			
<i>The Bidder shall give a list of all the components (indication of the make and reference)</i>			

## IT - 3307 / TS / LHCb

### PART A: UNIT PRICES - ELECTRICITY

The Bidder shall fill all the light blue cells of this document.  
All prices have to be considered for equipment completely installed.  
Unitary price will be used for any minor modification

Item	Unit	Unit Price (1) [CHF]	Unit	Unit Price of connection, marking and testing [CHF]
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<b>Power cables*</b>				
<i>*copper-cored power cables</i>				
-3x1.5 mm2	m	7.18	U	33.53
-4x1.5 mm2	m	7.64	U	33.53
-4x2.5 mm2	m	9.95	U	33.53
-4x2.5 mm2 (shielded)	m	14.71	U	33.53
-4x4 mm2 (shielded)	m	20.89	U	33.53
-4x6 mm2	m	16.80	U	33.53
...	m		U	
...	m		U	
...	m		U	
<i>(1) Supply and installation</i>				

Item	Unit	Unit Price (1) [CHF]	Unit	Unit Price of connection, marking and testing [CHF]
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<b>Control cables</b>				
-2x0.5 mm2	m	6.38	U	33.53
-4x0.5 mm2	m	6.70	U	33.53
-2x0.75 mm2	m	6.49	U	33.53
-4x0.75 mm2	m	6.81	U	33.53
-8x0.75 mm2	m	7.44	U	33.53
-2x1 mm2	m	6.61	U	33.53
-4x1 mm2	m	6.93	U	33.53
-12x1 mm2	m	9.43	U	33.53
-18x1 mm2	m	10.31	U	33.53
-28x1 mm2	m	13.17	U	33.53
-12x1.5 mm2	m	10.61	U	33.53
-48x1.5 mm2	m	24.76	U	33.53
...	m		U	
...	m		U	
...	m		U	
<i>(1) Supply and installation</i>				

Item	Unit	Unit Price (1) [CHF]	Unit	Unit Price of support and fixing [CHF]
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<b>Cable trays</b>				
-width : 200 mm	lg.3m	101.46	U	36.08
-width : 100 mm	lg.3m	80.85	U	36.08
-telex rail (width 50 mm)	m	42.25	U	24.05
...	m		U	
...	m		U	
...	m		U	
<i>(1) Supply and installation</i>				

Item	Unit	Unit Price (1) [CHF]
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<b>Power electronic devices</b>		
-frequency converter (nominal power= 5.5 kW)	U	2159.19
-frequency converter (nominal power = 7.5 kW)	U	2600.06
-frequency converter (nominal power = 11 kW)	U	3189.18
...	U	
...	U	
<i>(1) Supply and installation</i>		

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PART B: WORK LOTS PRICES

**WORK LOT 1: Hydraulic and Mechanical works for Outer Tracker cooling system**

<b>1.1 OUTER TRACKER COOLING STATION</b>	
Construction at the factory	79,312
Engineering	13,309
Installation on site	732
Documentation on paper and electronic format	652
Factory and on-site tests	842
Commissioning and acceptance	1,095
Training	713
<b>Total 1.1 [CHF]</b>	<b>96,655</b>
<b>TOTAL WORK LOT 1 [CHF]</b>	
	<b>96655</b>

**IT - 3307/ TS / LHCb**

**PART B: WORK LOTS PRICES**

**WORK LOT 2: CONTROL WORKS for OT cooling system**

Item	Unit	Quantity	Unit Price [CHF]	Total Price [CHF]
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**2.1 CONTROL EQUIPMENT AND INSTRUMENTATION**

Item	Unit	Quantity	Unit Price [CHF]	Total Price [CHF]
<b>PLC</b>				
Power supply module 24 Vdc	U	1	560.6	561
CPU module Schneider (TSXP57353M)	U	1	3823.6	3,824
Ethernet communication module (ESY 210)	U	1	3783.8	3,784
Binary inputs module 24 Vdc 16 channels (DEY)	U	3	283.8	851
Binary outputs module 24 Vdc 8 channels (DSY)	U	3	247.7	743
Analog inputs module 8 isolated channels (AEY)	U	2	981.0	1,962
Analog inputs module 4 isolated channels for PT100 connection 4 wires	U	4	840.8	3,363
Analog outputs module 4 isolated channels (ASY)	U	1	1051.1	1,051
Racks, connectors and other accessories	ass.	1	1258.3	1,258
<b>PC</b>				
PC Windows XP platform	U	1	4361.2	4361
<b>Instrumentation*</b>				
Pressure switch	U	2	481.6	963
Flow meter switch	U	12	676.9	8123
Temperature switch	U	2	325.8	652
Pressure transmitter	U	2	623.8	1248
Flow transmitter	U	3	2115.7	6347
Level transmitter	U	1	1376.2	1376
Conductivity transmitter	U	1	2596.2	2596
Temperature transmitter	U	3	429.1	1287
Temperature probe direct connexion to PLC	U	14	519.9	7278
<i>*Instruments connected to the control systems</i>				
<b>Local indicators and gauges</b>				
Pressure gauge	U	1	295.7	296
			Total 2.1	51,925

Item	Unit	Quantity	Unit Price [CHF]	Total Price [CHF]
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## 2.2 SAFETY

Emergency stop on pumps	U	2	43.4	87
Emergency stop on power and control cubicle	U	1	201.0	201
Hardwired interlocks between PLC and ECR DCS racks, including connection and testing*	U	4	56.6	226
<i>*Control cables for these interlocks are included in work lot 3</i>				
			Total 2.2	514

Item	Unit	Quantity	Unit Price [CHF]	Total Price [CHF]
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## 2.3 SOFTWARE DEVELOPMENT PROJECT\*

*\*Includes PLCs applications and SCADA software applications and network communication for the*

### UR phase: problem definition (identification of requirements)

Activities, deliverable items and reviews:

- Analysis of basic URD provided by CERN	ass.	1	66.4	66
- UR Definition Meeting at CERN premises	ass.	1	66.4	66
- User Requirements Document	ass.	1	66.4	66
- Definition of Acceptance Tests	ass.	1	66.4	66
- UR Review Meeting, at CERN premises	ass.	1	265.5	265

### SR phase: analysis (construction of logical model)

Activities, deliverable items and reviews:

- Software Requirements Document	ass.	1	1,327.3	1,327
- Definition of System Tests	ass.	1	331.8	332
- SR Review Meeting, at CERN premises	ass.	1	331.8	332

### AD phase: architectural design (construction of physical model)

Activities, deliverable items and reviews:

- Architecture Design Document	ass.	1	663.7	664
- Definition of Unit Tests	ass.	1	199.1	199
- AD Review Meeting, at CERN premises	ass.	1	199.1	199

### DD phase: detailed design & production (coding)

Activities, deliverable items and reviews:

- Detailed Design Document	ass.	1	663.7	664
- Code	ass.	1	464.6	465
- Software User Manual Document	ass.	1	464.6	465
- Final Software Verification & Validation Plan	ass.	1	132.7	133
- DD Review Meeting, at CERN premises	ass.	1	265.5	265

### Factory verification and validation

Activities and deliverable items:

- Installation of test platform	ass.	1	1,012.5	1,013
- Factory verification and validation, according to SVVP	ass.	1	639.0	639
- Test records	ass.	1	639.0	639

### Miscellaneous

Intermediate deliverable items or accessories:

- Drawings and documents for comments,	ass.	1	265.5	265
- CD-Roms, etc.	ass.	1	66.4	66

	Total 2.3	8,197
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Item	Unit	Quantity	Unit Price [CHF]	Total Price [CHF]
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**2.4 COMMUNICATION WITH THE MIXED WATER PRODUCTION CONTROL PLC**

*\*Includes Ethernet TC/IP communication with an external process control PLC (type Schneider TSX) for recovery of some few general data (general status, general alarm, etc.)*

- Integration of process data in the OT cooling system PLC and SCADA databases	ass.	1	929.1	929
- Integration in the local supervision tools: alarms, archiving, etc.	ass.	1	929.1	929
- On-site installation verification and validation tests	ass.	1	838.1	838
- Update of the OT cooling system PLC and SCADA application documentation	ass.	1	265.5	265
			Total 2.4	2,962

Item	Unit	Quantity	Unit Price [CHF]	Total Price [CHF]
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## 2.5 INTEGRATION OF EXTERNAL COOLING SYSTEMS IN THE LOCAL

*\*Includes integration in SCADA application and Ethernet TCP/IP communication with external process control PLCs, for the complete databases*

### **RICH 1 and RICH 2 Cooling system (1 PLC type Schneider TSX)**

- Integration of process data in SCADA databases	ass.	1	1,858.2	1,858
- Integration and development of local supervision tools: alarms, trending, archiving, etc.	ass.	1	1,858.2	1,858
- On-site installation verification and validation tests	ass.	1	1,278.0	1,278
- Update of the SCADA application documentation	ass.	1	265.5	265

### **IT and TT Cooling system (1 PLC type Schneider TSX)**

- Integration of process data in SCADA databases	ass.	1	1,858.2	1,858
- Integration and development of local supervision tools: alarms, trending, archiving, etc.	ass.	1	1,858.2	1,858
- On-site installation verification and validation tests	ass.	1	1,278.0	1,278
- Update of the SCADA application documentation	ass.	1	265.5	265

### **VELO Cooling system (1 PLC type Schneider TSX)**

- Integration of process data in SCADA databases	ass.	1	1,858.2	1,858
- Integration and development of local supervision tools: alarms, trending, archiving, etc.	ass.	1	1,858.2	1,858
- On-site installation verification and validation tests	ass.	1	1,278.0	1,278
- Update of the SCADA application documentation	ass.	1	265.5	265

Total 2.5	15,780
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Item	Unit	Quantity	Unit Price [CHF]	Total Price [CHF]
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## 2.6 ON-SITE VALIDATION TESTS

- Static tests (process control and local supervision)	ass.	1	1,278.0	1,278
- Dynamic tests (process control and local supervision)	ass.	1	1,278.0	1,278
Total 2.6	2,556			

Item	Unit	Quantity	Unit Price [CHF]	Total Price [CHF]
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<b>2.7 INTEGRATION IN THE CCC</b>				
- Database table (Excel pre-defined form)	ass.	1	929.1	929
- Installation and configuration of the software communication module provided by CERN in the PLC	ass.	1	929.1	929
- On-site verification and validation tests in coordination with CCC global planning	ass.	1	1,278.0	1,278
			Total 2.7	3,136

Item	Unit	Quantity	Unit Price [CHF]	Total Price [CHF]
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<b>2.8 INTEGRATION IN THE ECR</b>				
- Database table (Excel pre-defined form)	ass.	1	929.1	929
- On-site verification and validation tests in coordination with ECR DCS global planning	ass.	1	1,278.0	1,278
			Total 3.8	2,207

<b>TOTAL WORK LOT 3 [CHF]</b>				<b>87,277</b>
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**PART B: WORK LOTS PRICES**

<b>WORK LOT 3: Electricity works for OT cooling system</b>
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Item	Unit	Quantity	Unit Price [CHF]	Total Price [CHF]
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<b>4.1 UIAO-00836 Power and contrôle cubicle*</b>				
-make : .....	ass.	1	15,363	15363
-dimensions (LxWxD) .....				
			Total 3.1	15,363

\* including all the components with the exception of the PLC components listed in WL2

Item	Unit	Quantity	Unit Price [CHF]	Total Price [CHF]
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<b>4.5 CABLE CARRIERS AND CABLING</b>				
<b>Cable carriers</b>				
-width : 100 mm	m	15	45.23	678
-telex rail: 50 mm	m	20	14.81	296
-support and fixing	ass.	1	2844.23	2844
<b>Power cables</b>				
- 4x1.5 mm2	m	7	13.93	98
- 4x2.5 mm2 (shielded)	m	10	17.72	177
...	m			
...	m			
-connection, marking and test	ass.	1	311.76	312
<b>Control cables</b>				
-2x0.5 mm2	m	30	6.06	182
-2x1 mm2	m	215	6.29	1353
-4x1 mm2	m	230	6.61	1521
-18x1 mm2	m	100	9.16	916
-48x1 mm2	m	50	11.51	575
...	m			
-connection, marking and test	ass.	1	1104.82	1105
			Total 3.2	10,057

Item	Unit	Quantity	Unit Price [CHF]	Total Price [CHF]
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<b>4.6 ELECTRICAL STUDIES</b>				
-calculation notes	ass.	1	929.12	929
-cabling installation layouts	ass.	1	929.12	929
-schematics	ass.	1	2,654.62	2655
			Total 3.3	4,513

<b>TOTAL WORK LOT 3 [CHF]</b>	<b>29,933</b>
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**PART B: WORK LOTS PRICES**

<b>WORK LOT 4: Hydraulic and mechanical works for primary system</b>		
<b>4.1</b>	<b>PIPING</b>	
	Supply and installation of chilled water pipes with lagging	64,292
	Supply and installation of mixed water pipes	87,822
	Supply and installation of demineralised water line	7,846
	Supply and installation of air compressed air	15,524
	<b>Total 4.1 [CHF]</b>	<b>175,485</b>
<b>4.2</b>	<b>STRAIGHT CONNECTIONS</b>	
	Straight connections on chilled water for counting houses, RICH 1-2 and VELO cooling stations (with lagging, valves and fitting)	5,861
	Straight connections on chilled water for counting houses, Outer Tracker, Inner and Tracker Trigger (with valves and fitting)	33,535
	Straight connections on compressed air pipes (with valves and fitting)	980
	<b>Total 4.2 [CHF]</b>	<b>40,377</b>
<b>4.3</b>	<b>SUPPORTS</b>	
	Supply and installation of steel profiles	12,863
	<b>Total 4.3 [CHF]</b>	<b>12,863</b>
<b>4.4</b>	<b>DOCUMENTATION ON PAPER AND ELECTRONIC FORMAT</b>	
	according to section 1.5 of technical specification	3,997
	<b>Total 4.4[CHF]</b>	<b>3,997</b>
<b>4.5</b>	<b>FACTORY AND ON SITE TESTS</b>	
	according to section 3 of technical specification	1,734
	<b>Total 4.5[CHF]</b>	<b>1,734</b>
<b>4.6</b>	<b>COMMISSIONNING AND ACCEPTANCE</b>	
		2,460
	<b>Total 4.6[CHF]</b>	<b>2,460</b>
<b>4.7</b>	<b>TRAINING</b>	
		2,939
	<b>Total 4.7[CHF]</b>	<b>2,939</b>
<b>TOTAL WORK LOT 4 [CHF]</b>		<b>239854</b>