STATE AND PROSPECTS OF DEVELOPMENT
OF MODULAR HYDROCARBON GAS
COMPRESSING PLANTS HAVING
A 6.3 MW GAS TURBINE DRIVE

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Technical characteristics of the plants, such as petroleum gas gathering and transportation, petroleum
gas-lift, transportation of natural gas at both linear and booster gas compressing stations, etc., are given.
Trends of further development of compressor plants having an aircraft-type gas turbine drive with a power
of as much as 6.3 MW are formulated.

A major trend of compressor equipment development at SMNPO im. M. V. Frunze is creation of new prototypes of
modular (unitized) compressor plants (MCP) for gas and oil industry compressor stations (CS). In general, these are newly
built facilities, namely, petroleum gas gathering and transporting stations, petroleum gas-lift, and linear and booster gas compres-
sor stations (LCS and BCS) built around MCPs having an aircraft-type gas turbine drive (GTD).

As GTD, use is made of 4–8 MW D-336 series of engines designed by Progress Design Office im. Akademika
A. G. Ivchenko in Zaporozhie and made by Motor-Sich OAO. These engines produce the required power in a wide range of
ambient temperatures. In this context, SMNPO delivers and performs designer’s supervision of the use of the equipment
operating in diverse climatic zones, including in Ukraine, Russia, Turkmenistan, Iran, Turkey, and others.

The range of MCPs for oil and gas industry CS, whose production has been mastered by SMNPO, includes the
following types of equipment (Table 1): petroleum gas gathering and transporting, petroleum gas-lift, and natural gas
transporting as a unit of the BCS (CS of dwindling fields).

Analysis of the key parameters of the MCP shows that they have a wide range of applications in terms of gas com-
position, output, and initial $p_i$ and final $p_f$ pressure. The pressure (compression) ratio in the centrifugal compressor (CC)
varies in the range 1.55–4.7. The later figure pertains to BKKU-Ts-6.3A/1.2-5.7 (Astara CS) built for gas delivery through
the cross-country pipeline to Iran.

Note that in Table 1 we have listed compressor plants (CPs), which are linearly assembled as units of the CS and
delivered as complete assemblies. Currently, manufacture of such CPs for various purposes has been expanded considerably
for the domestic industry and for export.

The methodological principles of the creation of modular equipment were formulated at SMNPO in the
1980–1990s and were validated in the developmental process under conditions of the manufacturing plant as well as in
the process of pilot tests on customer’s facilities [1–4]. They are being used to create new and improve the existing MCPs
of various designs.
The CSs built around MCPs [5–6] are the largest facilities built by SMNPO experts in turnkey conditions with performance of a series of operations from zero cycle to startup operations in the construction process and servicing during operation. For their creation and introduction to production, it was necessary to manufacture various types of highly standardized equipment. In particular, for the first natural gas MCP, which is proposed to be used as a unit of the CS at Askishehir (Turkey), the equipment bank includes: a GPA (gas pumping unit)-Ts (centrifugal)-6.3A gas pumping unit, a dust-catcher (DC) unit with a system of piping and servicing platforms, air cooling devices (ACD), tanks for oil, condensate, etc., lubricating systems, an electrical unit, a unit for preparation of fuel and start-up gas, a set of pipeline assemblies and parts, a set of electrical equipment and CS instrumentation, more than 20 types of CS valves, and an assortment of spare parts and instruments.

The above list of equipment is typical for MCP for natural gas CS. Depending on local peculiarities and customer requirements, the equipment list can be expanded. For example, for the Haji Abad (Iran) LCS provision was made also for delivery of a gas-pressure-reducing unit for fuel and start-up gas of a gas-pumping unit (GPU) and of gas for CS needs, and a unit for gas preheating before pressure reduction. Also, provision was made for fitting the CS with a pulsed gas drying and storage unit for control of the pneumatic valve drives [6]. The volumes of delivery of automatic control systems (ACS) of the CS also vary widely on account of the conditions of CS functioning in the gas pipeline system.

The list of equipment for delivery of natural gas MCP expands considerably due to diversity of designs of the centrifugal compressors (CC) of the units, presence of systems for separation, gathering, and transportation of the condensate, torch systems, and systems for gas drying, purging of the technological loop with nitrogen, and others.

One of SMNPO’s most recent developments is a complex of modularly built equipment for the Astara CS. Considering that the CP of this station can be used for transporting both natural and petroleum gas, we shall discuss the special features of the design of the modular plant having a 6.3 MW gas turbine drive. In comparison with the equipment built by

<table>
<thead>
<tr>
<th>Equipment mark</th>
<th>Commercial output, Mm³/day</th>
<th>Pressure, MPa</th>
<th>Temperature, K</th>
<th>Centrifugal compressor rotor speed, rpm</th>
<th>Power consumption, MW</th>
<th>Molecular mass of the gas, kg/k mole</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>UKTG-1.5-6.3/0.35-2.6</td>
<td>1.2–1.6</td>
<td>0.35</td>
<td>2.55</td>
<td>283.0</td>
<td>313</td>
<td>8200</td>
<td>5.3</td>
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<td>UKTN-1.0-6.3/2.6-12</td>
<td>0.8–1.2</td>
<td>2.55</td>
<td>11.7</td>
<td>313.0</td>
<td>323</td>
<td>11790–17685</td>
<td>3.9</td>
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<tr>
<td>BKKU-Ts-6.3A/71-1.55</td>
<td>5.52–6.48</td>
<td>3.1–4.6</td>
<td>5.2–7.1</td>
<td>293.0</td>
<td>334–340</td>
<td>6800–8000</td>
<td>3.7–6.8</td>
</tr>
<tr>
<td>BKKU-Ts-6.3A/1.2-5.7</td>
<td>1.2</td>
<td>1.2</td>
<td>5.7</td>
<td>301.0</td>
<td>328</td>
<td>8200</td>
<td>4.1</td>
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<td>BKKU-Ts-8A/82-1.78</td>
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<td>4.63</td>
<td>8.17</td>
<td>300.7</td>
<td>328</td>
<td>8050</td>
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<td>TKA-Ts-6.3A/0.52-3.77</td>
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<td>0.52</td>
<td>3.75</td>
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<td>328</td>
<td>8000</td>
<td>4.3</td>
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