International Journal of Innovative Research in Computer Science & Technology (IJIRCST)
ISSN: 2347-5552, Volume-5, Issue-5, September-2017

Behavior of Plastic Working in Oil-Field Equipment

N. A. Gasanova

***Abstract*— Researches were made for the purpose of increase of labor productivity and replace of non-ferrous metals and ferrous metals by plastics. Details for this purpose are selected with a certain characteristic that further the developed technological process could be applied in the oil and gas industry.Plastic materials have the difficult intense nature and differ from metals markedly the expressed deviations from property of ideally elastic solid bodies.**

***Index Terms*— Plastic materials, reliability, quality, durability, thermalendurance**

I. INTRODUCTION

At present plastic masses are widely used. They are used in all industry fields, in the form of pressed products or half-stuffs, in the form of various profile (ribbons, rods, tubes, board, film etc.) [1].

High mechanical durability of some plastic materials has allowed applying them as constructional details of various cars and equipment.

Problem of use of plastic for production of details of machines in any enterprise including in oil-field equipment, it is connected with availability of the synthetic materials satisfying experimental qualities during the work in oil-field equipment. In this regard it is necessary that machine-building enterprise carried out big research work on change of structures of details of knots and machines at their replacement[2].

Application of details from plastic in various designs gives the chance to reduce prime cost and labor input of production of the machinery and appliances, to reduce the weight of designs at simultaneous improvement of their quality and reliability. Advantages of use of plastic in designs are completely shown only at the correct design of plastic details.

Plastics possess also anticorrosive and rather high heat resistance. Thanks to the specified properties of many plastics they are applied in the oil-field equipment working in aggressive environment and heavy climatic conditions.

Manuscript received September 11, 2017.
N. A. Gasanova, Doctor of Philosophy on Technique, Azerbaijani State University of Oil and Industry Baku, Azerbaijan Republic

Based on the analysis of the structures and operating conditions the table 1 shows group of plastic parts that work and are subject to future replacement, and shows practical recommendations on the most rational methods for their production.

The following classification of details of machines for destination and for a constructive sign is offered:

K – large-size details;
A – details for aggressive , high-temperature and liquid environment;
P – couples of friction;
R – carved and reinforced details;
O – general purpose details;
N – loadeddetails.

II. OILFIELD EQUIPMENT AND DEVICES

Details of oilfield equipment, devices and general-purpose machines, given in table 1, work in different branches of engineering, and belong to the following classes (this classification is for the first time conducted):

1) Couples of friction, i.e. crenellated and worm gears, plain bearings, etc.;
2) Loaded details such as rollers, pulleys, stators, a turbo-drill, reducer lid, cups of bearings, traverse, bracket supports, corpus details, etc.;
3) Threaded detail such as muffs, columns, journal-boxes and corpuses of oil seal, corks, etc.;
4) General-purpose details such as blocks, dash-boards, lids, setting rings, helms, flywheels, etc.

Table 1: Details of Oilfield Equipment, Devices and General-Purpose Machines

Equipment name	Details name	Working conditions		Details from plastic		
		Environment	Tempe-rature, deg	Classes of details	Brand of plastic	Method of manufacture
1	2	3	4	5	6	7
Manifold UMV-250	sealing	oilwater	upto 50	A	polyethylene	injectionmoulding
Fountain armature	blanking cover	atmosphere	up to 20	N	polyethylene	–″–
Drilling rig	ventagelid	–″–	up to 40	R	phenoplast	pressing
–″–	sprinkler	oilwater	–″–	A	–″–	–″–
–″–	breather	–″–	–″–	A	–″–	–″–
Debit meter	float	oilwater	up to 40	A	polyethylene	injectionmoulding
Installationof "Azinmash-37A"	corpusofoilseal	–″–	–″–	P	–″–	–″–
Electricsubmerged pump	workingwheels	atmosphere	–″–	AN	polyamide	–″–
Electricsubmerged pump	packing lid	oilwater	up to 20	A	polyethylene	–″–
Bottom-holepump	anti-sandfilter	–″–	up to 40	A	–″–	–″–
–″–	protectivemuff	–″–	–″–	O	–″–	–″–
–″–	protectivehubcaps	atmosphere	up to 20	O	–″–	–″–
Ratchetmechanism	bearingcap	–″–	–″–	N	–″–	–″–
Compressor	guidebushing	air	up to 40	P	AFQM	–″–
Latch	dash-boardWeber	aqueousliquid	–″–	P	polyethylene	–″–
Swivel	protectivehubcap	atmosphere	up to 20	O	polystyrene	–″–
Turbo-drill	stator	aqueousliquid	up to 40	A	polyethylene	–″–
–″–	blankcover	aqueousliquid	–″–	A	polyethylene	–″–
–″–	–″–	alkalis and acids of low concentra-tion	up to 20	A	Kapronprimary orsecondary	injection moulding or autoclave method
–″–	closingsleeve	–″–	–″–	A	woodpress-crumb	hotpressing
Vacuum-filtersF=5m^2, F=10m^2	unyielding halfring	–″–	up to 100	A	–″–	–″–
–″–	through cover	–″–	–″–	A	–″–	–″–
–″–	blankcover	–″–	–″–	A		
Filterwithfibroussublayer	bearingcap	–″–				
Vacuum-filtersF= 3 m^2, F= 10 m^2, F= 20 m^2	nozzlecase	alkalis and acids of low and ave-rageconcen-tration	up to 50	A	polyethylenegranulated	pressing;molding pressing;injection moulding
Filterwithfibroussublayer	sleeve	alkalis and acids of low concentra-	up to 20	A	–″–	–″–

		tion				
Filters coated with glue F = 3 m^2	sleeve 50/40	inorganic acids of lowand ave-rage concen-tration	up to 60	A	–″–	–″–
Filter with fibrous sublayer	closingsleeve	alkalis and acids of low concentra-tion	up to 60	AN	polyethylenegranulated	pressing;molding pressing;injection moulding
–″–	hubcap	alkalis and acids of low concentra-tion	up to 20	AN	–″–	–″–
–″–	lubricantring	–″–	–″–	AN	–″–	–″–
–″–	remote sleeve	–″–	up to 200	AN	fluoroplas-tic-4	–″–
Filter from stainless steel F=3 $м^2$	remote ring	–″–	up to 100	AN	escaponpressing	–″–
Filter-drier	hubcap	weakacidenvironments	up to60	AR	asbestosfiber	
–″–	–″–	–″–	–″–		polyethylenegranulated	moldingpressing; injectionmoulding
–″–	transition for hubcap	–″–	–″–	AR	asbestosfiber	pressing
Crystalfilter	screw-nut	sulfuricacid 12%	–″–	A	faolite pressing,escapon	hotpressing
–″–	flange	–″–	–″–	A	polyethyleneND, powder	spraying in a fluidized bed
–″–	hairpin	–″–	–″–	AR	–″–	–″–
–″–	shim	–″–	–″–	A	–″–	–″–
–″–	hairpin	–″–	–″–	AR	–″–	–″–
–″–	specialshim	–″–	–″–	A	faolite pressing,escapon	hot pressing, spraying in a fluidized bed
–″–	lower part of the delivery pipe	–″–	–″–	A	–″–	–″–
–″–	middle part of the delivery pipe	–″–	–″–	A	polyethyleneND, powder	spraying in a fluidized bed
–″–	upper part of the delivery pipe	–″–	–″–	A	–″–	–″–
Normalizeddetails	cast-ironflywheels	neutral	18	OR	fiberreinforcedplastic pressing	hotpressing
Normalizeddetails	handlesoval	neutral	18	OR	fiberreinforcedplastic pressing	moldingpressing
–″–	butterdisheshubcaps	machineoil	18	AR	polyamide68	injectionmo

					granulated	ulding
–″–	handle button	neutral	up to 35	OR	fiberreinforcedplastic pressing	moldingpressing, hot pressing
–″–	bleederplugs	machineoil	up to 40	AR	kaprongranulated	injectionmoulding
–″–	end covers	–″–	up to 35	AR	fiber reinforced plastic pressing	hot pressing
–″–	closing ring	neutral	up to 50	AON	woodpress-crumb	–″–
CuttingtorchRKR-3	flywheel	normal	from –60 to +30	ON	fiber reinforced plastic pressing	moldingpressing
–″–	lever	–″–	–″–	ON	–″–	–″–
–″–	flywheel	–″–	–″–	ON	–″–	–″–
GeneratorQVR: 1,25 mm	–″–	–″–	–″–	ON	–″–	–″–
Tinshears NL-475A	–″–	air	roomtemperature	ON	–″–	–″–
6-level drying of transcmission table	pulley	air with a humidity of 75-80%	20–40	ON	–″–	–″–
Hydraulicreducing mechanism	helmSM-148	air with a humidity of 65–75%	20–40	ON	Etrol NSgranulated	hot pressing
Inclinedtransporter NT-1	roller	atmosphere	normal	ON	woodpress-crumb	–″–
–″–	–″–	–″–	–″–	PON	–″–	
–″–	hubcap	–″–	–″–	O	fiber reinforced plastic pressing	–″–
–″–	ring	–″–	–″–	O	–″–	–″–
–″–	–″–		–″–	PON	–″–	–″–
Inclinedlift NP-1	roller	–″–	–″–	PON	woodpress-crumb	–″–
–″–	toproller	–″–	–″–	PON	–″–	–″–
–″–	onlay	–″–	–″–	O	polyamide68 granulated	injectionmoulding
Inclinedlift NP-1	roller	atmosphere	normal	PON	fiber reinforced plastic pressing	hot pressing
Boiler KND-12M	cork	–″–	10–80	RON		pressing
–″–	boiledwaterreflector	water	100	O	kaprongranulated	injectionmoulding
Boiler KND-8	cork	atmosphere		RON	fiber reinforced plastic pressing	hot pressing
Piler stacking is self-propelled ShS-1	roller	–″–		O	woodpress-crumb	–″–
–″–	–″–	–″–		RON	fiber reinforced plastic pressing	–″–
–″–	cheek	–″–		PON	–″–	–″–
Boiler KND-200	cork	–″–		PON	–″–	–″–
Boiler KND-8	screw-nut of pipe	–″–	up to 18	RON	–″–	–″–
Transporterisunitized	glass	machineoil	from –40	ON	woodpress-crumb	–″–
–″–	ring	–″–	from –40	ON	asbestosfiberpressing	–″–

			to –50			
–″–	sleeve	–″–	from –40 to –50	ON	–″–	–″–
–″–	glass	–″–	from –40 to –50	ON	–″–	–″–

The specific features of plastics as structural materials make the constructor go to the solution of a number of important design problems: a) the choice of material; b) calculations of durability; c) choice of the main project parameters of the details and the technological process of its manufacture; d) final processing of the designing from the point of view of its technology; e) the comparative technical and economic analysis of the designed product.

III. EXPERIMENT RESULT

In Table 1, the proposed parts, which are made of various plastics, when used in the design of oil-field equipment are selected on the basis of the following. Since plastic materials have a dense strained nature and differ from metals with sharply pronounced imperfections from the properties of ideally elastic solids. Here, in accordance with the law of Hook's, the voltage is always directly proportional to the deformation and does not depend on its velocity or on the properties of ideally viscous liquids, for which, in accordance with Newton's law, the voltage is always directly proportional to the deformation velocity and does not depend on the deformation itself.

Plastics have two main types of deviations of classic cases:

Velocity of deformation is not proportional to the stress, but is associated with it more than the same dependency; voltage depends on the deformation and its velocity, as well as on the higher high-level deformations for time.)

The velocity of deformation is not proportional to stress, but is associated with it more than a dependency. Tension depends on deformation and its speed, and also on higher derivative deformations for time.

IV. CONCLUSION

The article proposes details, which are made of various plastics, when used in the design of oil-field equipment. Plastic materials have a dense strained nature and differ from metals with sharply pronounced imperfections from the properties of ideally elastic solids.

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