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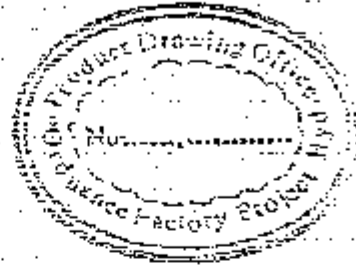
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SUPERSEDES

TTA-416

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MASTER COPY

TECHNICAL REQUIREMENTS
FOR CASTING AND ACCEPTANCE OF
CAST-IRON PARTS
TTA-416

50(a) 765

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INTRODUCTION:

1. The present technical requirements deal with the cast parts made of grey and special grades of cast-iron.

Cast parts made of cast-iron of grades *AYC-1* are accepted in compliance with GOST 1585-79.

Cast parts made of grey cast iron are accepted in compliance with GOST 1412-79. Parts made of cast-iron *XHB* and *CYM-1* are accepted as per the present technical requirements.

2. Distribution of cast-parts which are specified in the present technical requirements according to grades of cast-iron is given in ~~table~~ ^{table} no.1.

Table:1

Sl. No.	Number of parts	Description of parts	Grade of cast-iron
1.	765-12-136	sealing ring	<i>CYM-1</i>
2.	765-12-175	bushing	<i>AYC-1</i>
3.	765-12-226	sealing ring	<i>XHB</i> <i>AYC-1</i>
4.	765-17-3	bushing	<i>AYC-1</i>
5.	765-17-4	bushing	<i>AYC-1</i>
6.	765-17-5	bushing	<i>AYC-1</i>
7.	765-17-6	bushing	<i>AYC-1</i>
8.	765-17-7	swing arm	<i>AYC-1</i>
9.	765-17-8	bushing	<i>AYC-1</i>
10.	765-17-9	bushing	
11.	765-17-10	bushing	
12.	765-17-210	"	
13.	765-17-252	"	
14.	765-17-300	"	
15.	765-17-304	"	
16.	765-22-22	ring	<i>CYM-1</i> <i>XHB</i>
17.	765-24-151	bushing	<i>AYC-1</i>

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1	2	3	4
18	765-54-71	bushing	AQC-1
19	765-64-545	roller	AQC-1
20	765-17-407	bushing	AQC-1
21	765-17-439	bushing	AQC-1

3. The present technical requirements and drawings of castings and parts listed above are the only documents for their acceptance and for the guide lines for their manufacture.

III GENERAL:

contd.

4. Parts are provided by the approved production process.

Sealing rings of cast-iron CYN-1 and XNA are manufacture from ring-pots cast in molds, with metal smelted in electric furnace.

Other parts are cast from cast-iron smelted cupola electric furnace or by duplicating process:

Cupola to electric furnace.

5. Chemical composition and mechanical properties of cast-iron should comply with the instructions of drawing and table no. 2

Table No. 2

Contents of Elements, Percent													Mechanical Properties		
Grade of cast iron	C (free)	C (fixed)	Si	C+Si	Mn	S max.	P	Cr	Ni	Cu	W	Bending strength kg/mm ²	Sag mm	Brinell Hardness	
														BHN	Dia. of indentation
C4 20	3.1	-	1.8	5.0	0.8	0.12	0.2	0.3	0.5	-	-	40	3	170	4.6
	3.4	-	2.2	5.3	1.2	0.12	0.2	0.3	0.5	-	-			255	3.8
A4C-I	3.2	-	1.6	-	0.9	0.12	0.15	0.2	0.3	0.8	-	-	-	180	4.5
	3.6	-	2.2	-	1.2	0.12	0.30	0.40	0.3	1.6	-			241	3.9
XHB	2.9	0.65	1.4	-	0.6	0.10	0.4	0.3	0.6	-	0.5	-	-	283	3.6
	3.2	0.90	1.9	-	1.0	0.10	0.65	0.6	1.4	-	0.8			241	3.9
Special Cast Iron	3.0	-	1.8	-	1.8	upto	0.3	0.2	0.3	-	-	-	-	207	4.2
	3.4	-	2.2	-	2.2	0.15	0.6	0.2	0.3	-	-			269	3.7
C4M-I	2.9	0.65	^a 1.5	^a 4.3	^a 1.2	^a 0.12	^a 0.3	^a 0.2	^a 0.3	-	-	-	-	302	3.5
	3.2	0.9	1.8	4.9	1.5	0.12	0.6	0.4	0.6	-	-			241	3.9

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NOTE: 1. Chemical composition of grey cast-iron is not a ~~control~~ ^{control} for rejection if hardness and mechanical properties comply with norms.

2. For cast iron of grade 440-1, specified content of chromium and copper is compulsory and its deviation is a ~~cause for rejection~~ ^{cause for rejection}. Dispatch of parts with deviations in ~~cause for rejection~~ ^{cause for rejection} is a ~~cause for rejection~~ ^{cause for rejection}. Deviations in these elements is decided by the plant chief metallurgical engineer if the structure and hardness of the parts are normal.

3. For cast-iron of grades 47/and XH5 content of P, S iron C is compulsory and deviations from the specified limits is a ~~cause for rejection~~ ^{cause for rejection}. If the structure and hardness are normal ~~cause for rejection~~ ^{cause for rejection} may be allowed for the remaining elements but only with the permission in writing by chief metallurgical engineer as per the table 3.

Table 3

Grade of cast iron	2	3	4	5	6
	± 0.10	± 0.2	± 0.15 -0.10	$+0.10$	$+0.30$
	$+0.15$ -0.10	$+0.2$	± 0.15	$+0.30$	$+0.30$

4. Dispatch of castings made of special cast-iron having deviations in 7

Within the limits of ± 0.1 for production is decided by the plant chief metallurgical engineer in each individual case. Specified content of Mn, S and P is compulsory and deviation from the specified limits is a ~~cause for rejection~~ ^{cause for rejection}.

Look will be used for cast-iron of grades GYH 1 and HPA should be R & from 97 to 104. If the structure of metal of grade HPA is normal, then hardness of ring pots and pinning rings may be upto Rockwell C70 and upto ^{150 BHN} ~~150 BHN~~ ~~150 BHN~~ ~~150 BHN~~.

4. Chemical composition and mechanical properties of grades of ~~GYH~~ cast-iron are determined on castings from every batch is compliance with GOST 1412-79.

5. Chemical composition of castings made of special cast-iron AYU-1, GYH and HPA is determined on every melting by laboratory. One shift work of melting until an one same modes is considered as one melting. If working of the furnace has interrupted modes casting cast with cast-iron of one charge are considered as one melting.

6. Chemical composition of grey cast-iron is determined as per the instructions for ~~melting~~ the cast iron in cupola or electric furnace.

7. Before forwarding to machine shop the castings should be cleaned from burrs, forming sand, should be cut and fettled with every steel templates of burrs, pourings, risers and air-gates.

8. The castings should be without hard spots cavities, cracks, cold laps and other defects and also without configuration and dimensions-alignment variations from tolerances for them both on places to be machined and not to be machined according to the requirements for casting drawing and part drawings.

NOTES: The permissible castings defects on castings and parts after machining are specified in sheet number 13 of the present technical requirements.

10. Castings made of cast iron of grade AYc-1 should have macrostructure as per

11. Microstructure for Fe_3C and FeS should consist of continuous ferritic base of numbers 48, 49, 50, 51, 52, 53, 54, 55, 56, 57 and Fe_3C eutectic and inclusions of double phosphide ~~eutectic~~ of numbers 41, 51 and 53 against the standard scale of central plant laboratory (enclosed).

The following are not allowed:

- a) Structural free cementite (hard phases) or perlite of numbers 715, 716, and 717.
- b) ^{Slava} Structural free ferrite perlite of numbers 711, 712, 713, 714, 715, 716 and 717.
- c) Binary phosphide eutectic of numbers 54 and 55.
- d) Tertiary phosphide eutectic at the rate of not more than 2 inclusions in the field of vision at 100 power magnification.
- e) Graphite of numbers 711, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

The following are allowed:

- a) Perlite of transition number 77 provided it occurs locally at the rate of not more than 3 localities with each specific area of not more than 10% and their total area is not more than 20% of field of vision at 400 power magnification.
- b) Binary phosphide eutectic of number 54 i.e. the form of small localities uniformly distributed i.e. without segregating in one place of micro-section metallographic specimen if their total area does not exceed 20% of the specimen area.

9) Heavy phosphoribrids enable upto 25% of total number of phosphoribrids for cast iron of grades, XH3

1.2. Numbers of melt and therefore possible numbers of parts ~~should~~ be cast on castings in compliance with the drawing instructions.

Checking norms of castings.

13. ^{castings} The castings intended for despatch should be checked for:

a) For mechanical properties against reference cast bars. It consists in bending for castings of the given melting max of cast iron.

b) The first check is carried out on 3 bars, if check results for bars are satisfactory then the melting is considered to be fit. In case of unsatisfactory check results for ~~the~~ bars. Check ^{is} carried out on 3 more other bars.

If during duplicate tests one gives unsatisfactory results then all the castings of the melting under check are rejected.

NOTE: Check results for the specimens with defects are not considered and the specimens are replaced by spare ones from the same melting.

b) For casting defects which are permitted by the casting drawing of the part and part technical requirements. Check ~~carries out~~ ^{not} castings.

NOTE: Any defects which can be rectified by machining are allowed on castings surfaces to be machined.

- c) For compliance of dimensions and shape with the casting drawing in external indications (cross-joint etc) by 100% and in all dimensions by marking-out periodically as per the MID SCALE.
- d) For Brinell hardness ($P=750g$, $d=5mm$) on surface to be machined casting at the rate of 10% of the batch are to be checked. In case of deviations 100% of castings of the given designation are checked.

Bushings of grade AYC-1 may be checked as per Rockwell method (scale B). *Rockwell Pits for Sealing wires are to be inspected to 100%. Checking for hard spots*

- e) For absence of hard-spots by filing faces of casting with file cut file 5% of a batch should be subjected to this check. If hard-spots are found on atleast one casting, then all the castings are to be checked, casting with hard drop are rejected.

NOTE: Hard drop may be rectified by a special heat-treatment modes provided it results compliance with the technical requirements for hardness and micro-structure.

- f) For microstructures of casting made of cast-iron of grade AYC-1 check is carried out on 3 pieces fit as per hardness and taken from every melting as well as from every designation when cast from cupola or electric furnace. If the ^{micro}structures do not comply then it is rechecked on doubled number of casting. If the microstructures is unsatisfactory, when rechecked then the batch castings under check is to be rejected.

- g) For microstructure of special cast-iron parts

Check is carried out on 3 castings from a melting
in sections which are most tend to formation of
cementite (hard spots) at a distance of 5 to 10cm
from the face.

Microstructure should consist of slightly white lines
~~of ferrite~~ ^{of graphite} of medium as well as of small size
coarse lamellar graphite. Locations are allowed
metallic base is thin lamellar or medium lamellar
~~Permitted defects~~ Ferrite is allowed upto 5% Phosphide
eutectic in form of separate inclusions is allowed
as locations of ternary phosphide eutectic (as per
according to the enclosed certified plant laboratory
scale).

14. The accepted castings are stamped with TID stamp
and forwarded to machine shop and accompanied by
invoice certified by TID.

15. Checking norms for ring pots:
(As per standards, based on 100, 1000 & 10000) and other defects beyond the allowance limits for
machining are rejected during in-process-out.

16. Complete melting is deviced into batches and
each ring pot is numbered:

The melting is deviced into batches in the
following way:

- a) first batch is ring pots number 1 to 60
- b) second batch is ring pots number 61 to 120
- c) third batch of the remaining bodies in ring-pots of
numbers 121 etc.

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17. The last ring-pot of the last ladle iron every piece should be partly broken from side of the bottom face and tested for hard spots.

18. If hard-spots are absent in the ring pots under test their prior hardness is checked in three points: in the centre of lateral surface and on bottom face in two diametrically opposite points are a satisfactory test when the gates is fettled to a depth of 1.5 to 2.0cm. Hardness in any of the three measuring points should be within the limits of HB 175 to 1.95m (P-7000), ~~HB 175 to 1.95m~~ and $t = 10 \text{ sec}$. *Red marks up to 10 sec*

19. If the depth of hard spot in the ring-pots under test is not more than 20m the hardness is checked at the same points. If the centre of lateral surface should be within the limits of HB 1.75 to 1.95m and at the measuring points on bottom face should be HB 1.6m/min that makes up HB 263 max the part of ring pot with hard spots is removed during machining.

20. If hard spot of depth exceeding 20m is present in the ring-pot under test then the batch is rejected.

2.1 The last ring-pot of the last ladle from every batch of its remaining recognised as fit as per hardness and hard spot is forwarded to the laboratory for checking. *Laboratory Ring pots etc etc*

22. Two longitudinal plates of width 15 to 20m are cut out from the checking ring-pots.

23. One area on the internal surface of one plate and two areas on the external surface of another are scraped with energy along the total length of ring-pot.

24. Number of melt and number of ring-pot are stamped on them.

25. One plate is ground on one-side Brinell hardness is measured in four points and ^{check} Brinell hardness (A/mils) eight ^{check} internal points along the length of plate leaving atleast 20mm from its edges. Brinell hardness should be 44.5 to 1.95mm and rockwell hardness should be 97.0 to 104.

26. On other plate two transverse cuts are made along the edges of one of the end with number of melt and ring pot and the area is ^{check} broken cut.

27. Microsection is made on one of cuts of the broken cut area and it is tested within the range of 2mm zone from the edges and also at a depth of 2mm.

28. In case of satisfactory results of microstructure check the melting batch is accepted.

In case of unsatisfactory microstructure check results all the ring pots of the last batch of the testing batch are rejected and last ring-pot of previous and next ladle are forwarded for rechecking. In case of unsatisfactory structure even in the case the batch of ring pots under check is rejected.

29. A chip is drilled from the remaining of the second plate and complete chemical analysis is carried out. The chemical composition should comply with the requirements specified in table No.1

30. The data on hardness microstructure and chemical analysis are entered in the laboratory book for ^{check} ring pot checking and in certificate for melting. The certificate for melting should be ^{sent} forwarded to MTD of iron foundry not later than one day after receiving

Chemical

30. Melting ring pots.

31. After receiving the conclusions about fitness of castings all the ring pots are tagged with hammer. Ring pots with dull sound confirming the presence of cracks should be rejected.

3.2. Numbers of melt and ring-pots are stamped on protected area of the boss of upper face of ring-pots.

33. Personal bill (certificate) indicating number of melt and number of ring-pots in it is made up for melting.

34. The melting ring pots accepted according to melting are forwarded to machine shop accompanied by certificates.

CASTING DEFECTS ARE ALLOWED AFTER MACHINING:

35. Casting defects are not allowed on working surfaces of bushes and sealing rings.

36. Two cavities with a maximum diameter upto 1mm in depth up to 1mm are allowed on non-working surfaces of bushings if they are located not closer than 5mm from the ^{edges} ~~edges~~ of holes and butt-ends. The distances between the cavities is not less than 10mm.

Scale of ~~cast~~ cast-iron microstructures of a ring pot castings.

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