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QGZ 型气体干燥装置  
操作维护手册

Instruction Manual  
For QGZ Series Gas Drying Device



自贡川滤设备制造有限公司

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## 一、简介

我厂是分离机械设备定点生产厂，有近四十年研制、制造过滤机械的历史。产品设计先进，结构合理，制作工艺和检测设备完善。生产的 ZJA 型系列双级高真空净油机、ZJB 型系列单级真空净油机、ZJY 型系列真空净油机、ZJCQ 型系列透平油过滤机、ZLSG 型全自动滤水器、LY 型系列板框压力式滤油机、WLY 型微型系列滤油机、BAS 型板框压滤机、BAY 型系列轻便过滤机、JYG 型系列精密过滤机以及 2CY 型、KCB 型、WCB 型系列齿轮油泵等产品畅销国内，远销巴基斯坦、孟加拉、印尼、泰国、缅甸、伊朗、越南、叙利亚、独联体、科威特、古巴等二十多个国家和地区，在国内外市场上享有较高声誉。由我厂开发设计的 QGZ 系列气体干燥装置是依托科研院校的技术优势，共同研制开发出适用于电业系统、库房、包装、电子元件等行业进行气体（如环境空气、氢气、六氟化硫等）干燥的装备，特别是可替代传统的变压器热油循环干燥方式。

## 二、气体干燥的工作原理

2.1 本气体干燥装置是由气源系统、冷冻干燥系统、吸附干燥系统、PLC 电气控制系统四部份组成的低压力露点、移动式、风冷式高纯气体发生装置。

2.1.1 气源系统组成：由空气粉尘过滤器、全无油式空气压缩机组、空气冷却器（风冷）、气水分离器、过滤器组成，输出洁净无油的气体。

2.1.2 冷干机组成：本装置主要采用全封闭式高温压缩制冷机组，性能稳定可靠，可以获得更佳的制冷效果，其主要由全封闭式高温制冷压缩机组、

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油气分离器、热压力控制器、冷却器、电磁阀、干燥剂、热力膨胀阀及压力表等组成，冷媒采用 R22 制冷剂。

**2.1.3 吸附干燥系统组成：**吸附干燥是由 A、B 两个吸附塔、电磁阀、气体梭阀、出口加热器、出口控制阀、单向阀、压力表组成。

吸附干燥所用吸附剂由分子筛、变色硅胶组成，分子筛为吸附剂，变色硅胶主要起到观察作用。冷冻干燥系统处理后的压力露点在  $2^{\circ}\text{C} - 10^{\circ}\text{C}$  的气体经过吸附干燥系统后可达到  $-55^{\circ}\text{C} - 60^{\circ}\text{C}$  压力露点。

**2.1.4 PLC 电气控制系统：**电气控制系统采用日本三菱 PLC 可编程控制器为核心，自动完成全部操作过程。电气元件全部采用法国施耐德，确保了本装置安全可靠运行。

## 2.2 设备原理和流程

首先用户应将设备出气口与需要干燥的对象进行连接，并连接好设备主电源，点击电控柜面板上的：“启动”按钮，冷干机启动（冷干机要达到最佳制冷效果需要 2 分钟左右，因此首先启动冷干机，进行预冷），PLC 计时 2 分钟后，一号空压机和空气预冷器启动，5 秒后二号空压机启动。两台空压机均启动后，气源系统进入工作状态。空压机产生  $85^{\circ}\text{C}$  的高温压缩空气，经过粉尘过滤器进行尘埃脱离后进入空气预冷器，气体温度降至  $35 - 45^{\circ}\text{C}$ ，气体中所含水蒸汽由于聚然温降的作用开始析出，再经过冷干机高效急速冷却，气体中 90% 的水蒸汽析出并与冷干机的低温管道接触，瞬间液化形成水粒，通过气水分离器与气体脱离，经过前面的步骤脱水后的气体进入吸附系统。

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以吸附塔 A 吸附、吸附塔 B 解吸为例，气体从吸附塔 A 底部 A1 电磁阀进入，由下而上通过吸附塔 A，与吸附材料分子筛进行接触（分子筛为人工合成的沸石为原料，通过加入羊甘土为粘合剂后制成球状颗粒，呈白色，外表面分布无数微孔），水蒸汽会被分子筛吸附在其内部，气体达到需要的压力露点后经梭阀管道排出设备；与此同时，从梭阀管道中引出一部分合格后气体由上而下的吸附塔 B 进行解吸，解吸后的气体经 B2 电磁阀回到空压机排气口。A、B 吸附塔每 30 分钟进行一次切换，即 A 塔吸附 B 塔解吸或 B 塔吸附 A 塔解吸。A1 和 B2 电磁阀、B1 和 A2 电磁阀为同时开启，只要设备处于工作状态，这个循环会一直进行。

另外需要说明 4 点：

1 吸附塔的解吸功能不能代替必要的吸附材料烘干更换维护工作，只能延长吸附材料的使用周期；

2 冷干机配有强制水冷装置，当设备使用地环境温度高于 35℃时，应连接自来水进行强制冷却，以保证冷干机制冷效果；

3 出气口加热器为选用装置，即用户需要对干燥气体加热时，可将电控柜面板上的“加热器”旋钮拧至启用位置，加热器进入自动控温工作状态。对干燥气体进行加热的主要目的是使进行维护工作的人员感觉舒适。温控上下限的设置，通过对电接点温控表信号指针的设定来实现。使用结束，请将电控柜面板上的“加热器”旋钮拧至停止位置。

4 整机工作压力范围 0—1.0Mpa。出气口压力可用调节阀调至所需工作压力。

### 三、技术参数

型 号		QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	
参 数		0.3	0.6	1.0	1.5	3.0	6.0	10	15	30	60	80	100	150	200	
额定处理气量 Nm <sup>3</sup> /min		0.3	0.6	1.0	1.5	3.0	6.0	10	15	30	60	80	100	150	200	
工作压力		0.4~1.0Mpa      1.0~1.6Mpa														
成品气露点		-55℃~-60℃														
再生气耗量		3%-5% 额 定 处 理 气 量														
压力损失		0.01~0.03Mpa														
出气温度		0~80℃														
再生方式		有热或无热再生      周期：10~90min														
吸附剂		铝胶、变色硅胶、分子筛														
制冷剂		R12			R22											
吸干机	吸附压力	0.35~1.0 Mpa      0.5~1.6Mpa														
	解吸压力	0-0.15 MPa														
压缩机 HP		1/3	3/8	1/2	1/2	1	2	3	4	7.5	10	15	25	40	50	
电 源	功 率	5.5	7.5	9.7	13.8	33.5	38	42	由 空 压 站 供 气							
	电 压	380±10														
	相 数	三相														
进出气口径 DN		15	20	25	32	32	40	50	65	80	100	125	125	150	200	
外 形 尺 寸 mm	长	1000	1300	2080	2080	2200	2500	2500								
	宽	880	1660	1880	1880	1900	2200	2200								
	高	1680	1980	2200	2380	2680	2880	2980								
设备净重 kg		580	680	1080	1800	2280	2800	3800								

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## 四、电气系统及自动控制说明

4.1 本机的电气控制系统采用三菱 PLC 可编程控制器为核心，启动制冷压缩机 2 分钟后，气源系统和吸干机系统自动启动，加热器可根据工况需要是否开加热器（温度可调）。只要其中有制冷系统、气源系统、吸干机系统过载整机会自动停机。

4.2 吸附干燥解吸系统循环交替为 30 分钟切换一次；

4.3 在工作过程中，如果遇整机断电，所有程序将自动停止运行，PLC 程序重新扫描刷新，重新启动设备即可。

4.4 自动调节功能

制冷系统所有的热力膨胀阀、吸气和排气口截止阀均不需要进行人工调节或开起，开机后即能自动工作；空气系统的所有阀均为自动运行。

4.5 保护功能

当制冷压缩机压力超压、电流过载时整机自动停机，空压机输出压力超压时空压机自动停止工作，压力降到一定压力时空压机自动启动，电流过载时整机自动停机，空气冷却器电流过载时整机自动停机。

## 五、适用场所

5.1 本气体干燥装置整体安装在一个可移动的机架上，可直接运到工作现场使用。

5.2 将本装置的出气口通过软管与变压器接口相联接，开机后 10 分钟即可向变压器供给干燥气体进行干燥。

5.3 若需对变压器进行检修，应将本装置出气口通过软管与变压器进气

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孔连接好，向变压器输送新鲜干燥空气（输送的干燥空气要保证变压器的技术要求的露点温度），供给 2-4 名操作人员的干燥空气以检修变压器。在装、卸线圈时，将本装置的出气口用 DN20 或 DN38 软管联接好，再用小口径的软管合理分布到所需干燥的各个部位，保证在任何时候均处于最佳状态。

5.4 对出厂变压器的干燥加压储运，采用变径接头将本装置出气口与变压器排进气口相连，当变压器出气口的露点温度已达到要求时，关闭出气口，待变压器内形成约 105kPa 的正压时，然后再关闭本装置及进气口阀门，从而代替充氮储存或运输。

5.5 本装置还可适用于各种需要保持气体无粉尘及干燥的工作环境（如电子行业），以供给工作人员正常温度的干燥空气。

## 六、操作规程

### 6.1 操作准备

检查所接电源是否为三相 380V 50HZ 交流电，电源线能否承受整机功率，同时应检查空压机、空气冷却器风扇的旋向是否正确。

### 6.2 操作规程

6.2.1 启动机组前，首先把金属软管与本机出气口连接好，启动制冷压缩机，两分钟后空压机、空气冷却器、吸干机系统“自动启动”；注意观察制冷压缩机进出口压力表变化是否正常；观察露点仪（用户自配）上压力露点达到使用要求后，通过出口调节阀把干燥气体压力、气量（用户自配）调到所要求；加热器可根据工况需要是否打开，温度上限用户可根据需

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要自行调节。

6.3 空预器、冷干机、粉尘过滤器、气水过滤器均配有手动排水阀，运行 1-2 小时需进行手动排水。

6.4 供气完毕，点动“停止”按钮，气源系统、冷干机系统、吸附干燥系统及相关电磁阀自动停止工作。

## 七、机组的维护与保养

7.1 本气体干燥装置的制冷系统采用进口全封闭高温制冷压缩机组，制冷压缩机充入 R22 制冷剂，其进出口阀门均处于常开状态，制冷压缩机工作与否，均不需要作任何调节。

制冷系统的有关元器件分别采用进口意大利电磁阀、美国压力控制器、热力膨胀阀（出厂时已经调节好）、台湾压力表。只要本机组在接通电源的情况下，点动“起动”按钮，制冷系统将自动运行，点动“停止”按钮，制冷系统则随即关闭。

7.2 制冷压缩机正常的工作压力为 0.6-1.2MPa,吸气口压力一般为 0 以下,即处于真空状态,不工作状态时的吸气口和排气口压力相同,一般为 0.6-1.0MPa，主要与环境温度有关。

### 7.3 制冷剂的泄漏

剧烈的振动引起蒸发器换热管折裂，电磁阀的频繁开闭，长时间的工作，都会导致系统内制冷剂（R22）泄漏而减少。制冷剂的减少，将使整个气体干燥装置的制冷能力降低，干燥空气的露点温度达不到所要求，需要及时补充制冷剂。

### 7.4 制冷剂的补加



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当制冷剂减少到不能达到所需要的正常露点温度时，可将系统内残存的制冷剂放掉，然后对系统抽真空，抽到-0.096MPa 左右时,即可通过连接在压缩机进气或排气口处的压力表接口处加入制冷剂.其中,R22 制冷剂加入量为 1.2kg。

#### 7.4.1 具体操作方法如下：

A、用工具旋下连接于制冷压缩机吸气或排气口处的压力表接头，将已泄漏的制冷压缩机系统剩余制冷剂放掉。

B、用 DN8-DN12 的软管或氧气管将压缩机吸气（或排气）口压力表接头和高纯度氮气瓶连接好，充入 1.2MPa 左右压力的氮气，用肥皂泡检查系统各焊接处及阀门连接密封处，若无泄漏现象，即可进行下一步操作。

C、放掉系统内氮气，用软管或氧气管将压缩机吸气（或排气）口压力表接头和真空泵吸气口相连，开始对系统抽真空。

D、当系统被抽到-0.096MPa 左右的真空度时，旋下压缩机吸气口三通截止阀下部的密封帽，用搬手按逆时针方向旋转截止阀的阀杆，将压力表接头连通处封死，旋下抽真空接头。

E、用上述软管将压缩机吸气（或排气）口压力表接口与盛装制冷剂的钢瓶连接好，并将钢瓶放在台称上，用搬手按顺时针方向旋转三通截止阀下部阀杆，将压力表接头连通处打开，开始对系统充入制冷剂，充入重量为 R22： 1.2kg。

F、制冷剂补充完毕，仍用搬手按逆时针方向旋转截止阀的阀杆，将压力表接头连通处封死，安装好压力接头，再旋开，最后用密封帽封好三通截止阀。

#### 7.5 吸附材料的烘干与更换

吸附材料在达到饱和后会失效，设备无法再产生合格压力露点的干燥

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气体，因此对吸附材料的维护非常重要。

首先用户应定期通过 A、B 两塔的观察镜来观察其中的变色硅胶的颜色，变色硅胶在正常情况下外观为深蓝色，随着吸附水份的增强会逐渐变为粉红色，一旦其外观为粉红色即可说明该吸附塔中的吸附材料也临近失效，必须进行解潮处理。

操作过程为：首先需布置一个装料容器于吸附塔底部，打开放料塞子，待吸附材料全部放空后，将放料塞子重新堵上，吸附材料的解潮需要使用烘箱，恒温 120℃烘烤 2 小时左右后使其自然冷却后，打开吸附塔顶部的加料法兰盖，将分子筛重新填入吸附塔。注意，应观察装填位置，在位于观察镜时，必须装入与镜片位置对应的变色硅胶后再继续分子筛直至上层隔板为止，将加料法兰盖复位后，设备即可重新投入使用。



## 八、一般故障原因及排除

故障情况	产生原因	排除方法
露点温度达不到要求	1、制冷压缩机系统蒸发温度偏高	1、略调低制冷压缩机吸气压力
	2、排水管冰塞、蒸发器和热管换热器中结霜后积水	2、用电吹风加热排水管，使其化霜排水通畅
	3、进气量过大	3、调小进气量
	4、保温层潮湿，性能下降	4、加热烘干后，做好表面防潮层
	5、吸附剂吸附能力下降	5、增大再生托气量（调节再生调压阀）
	5、制冷剂的减少	5、根据情况，检漏后适时补充或更换
供气量不足	1、空气含湿量高，蒸发器结霜过厚堵塞	1、开大制冷膨胀阀
	2、空气管路系统密封不严产生漏气	2、检查并调整
	3、按管过长过细阻力过大	3、增大软管直径，机组尽量靠近变压器
	4、空气电磁阀动作失灵未打开	4、拆卸电磁阀蕊检修
	5、气泵长期使用性能下降	5、检修或更换

## 九、露点~ppm 换算表

<div>露点℃</div> <div>PPm</div> <div>露点℃</div>	00	01	02	03	04	05	06	07	08	09
-25	624.9	618.7	612.4	606.4	600.3	594.4	588.5	582.5	576.7	570.9
-26	565.3	559.5	553.9	548.4	542.8	537.4	532.0	526.7	521.3	516.1
-27	510.9	505.7	500.6	495.6	490.5	485.5	480.06	475.7	470.9	466.0
-28	461.3	456.7	452.0	447.4	442.8	438.3	433.8	429.3	425.0	420.6
-29	416.3	412.0	407.8	403.6	399.4	395.3	391.2	387.2	383.2	379.3
-30	375.3	371.5	367.6	363.8	360.0	356.3	352.5	348.9	345.2	341.7
-31	338.1	334.6	331.1	327.5	324.2	320.07	317.4	314.1	310.8	307.5
-32	304.2	301.1	297.9	294.8	291.6	288.5	285.5	282.5	279.5	276.5
-33	273.6	270.7	267.8	265.0	262.2	259.3	256.6	253.5	251.1	248.5
-34	245.8	243.1	240.5	238.0	235.4	232.9	230.04	227.9	225.5	223.0
-35	220.6	218.3	215.9	213.5	211.3	209.0	206.7	204.2	202.3	200.0
-36	197.8	195.8	193.6	191.5	189.3	187.4	185.3	183.2	181.2	179.3
-37	177.3	175.3	173.4	171.5	169.6	167.7	165.9	164.1	163.3	160.5
-38	158.7	157.0	155.2	153.5	151.7	150.0	148.4	146.8	145.1	143.5
-39	142.2	140.4	138.8	137.2	135.6	134.2	132.7	131.2	129.7	128.2
-40	126.8	125.4	124.0	122.5	121.1	119.8	118.5	111.7	115.8	114.5
-41	113.1	111.8	110.6	109.4	108.1	106.9	105.6	104.4	103.3	102.1
-42	100.9	99.70	98.65	97.52	96.40	95.29	94.20	93.11	92.08	90.98
-43	89.93	88.88	87.86	86.84	85.83	84.85	83.86	82.88	91.92	80.97
-44	80.03	79.09	78.17	77.27	76.36	75.47	74.58	73.72	72.48	71.99
-45	71.15	70.31	69.49	68.67	67.86	67.06	66.27	65.48	64.71	63.94
-46	63.19	62.44	61.70	60.97	60.24	59.53	58.86	58.11	57.42	56.73
-47	56.05	55.39	54.72	54.07	53.42	52.77	52.14	51.52	50.90	50.29
-48	49.67	49.08	48.49	47.90	47.32	46.75	46.18	45.62	45.06	44.52
-49	43.98	43.45	42.91	42.39	41.88	41.36	40.86	40.36	39.86	39.38
-50	38.89	38.41	37.94	37.47	37.01	36.55	36.11	35.66	35.22	34.79
-51	34.35	33.93	33.50	33.09	32.69	32.27	31.88	31.45	31.09	30.69
-52	30.32	29.93	29.56	29.19	28.80	28.46	28.10	27.75	27.40	27.06
-53	26.71	26.38	26.05	25.72	25.39	25.07	24.75	24.44	24.13	23.86
-54	23.51	23.22	22.93	22.64	22.34	22.05	21.78	21.50	21.22	20.95
-55	20.68	20.41	20.16	11.89	19.63	19.39	19.13	18.88	18.64	18.40

## 十、露点和含水量（ppm）

露点（℃）	含水量（ppm）		露点（℃）	含水量（ppm）
-60	13.6		-14	1892
-58	17.75		-12	2250
-56	22.9		-10	2670
-54	30.0		-8	3140
-52	36.0		-6	3730
-50	47.5		-4	4390
-48	60.5		-2	5160
-46	76.4		0	6043
-44	96.0		2	6950
-42	119.7		4	7950
-40	149.5		6	9040
-38	185.0		8	10300
-36	228.0		10	11820
-34	282.0		12	13420
-32	356.0		14	15080
-30	425.0		16	17000
-28	517.0		18	19070
-26	622.0		20	21500
-24	765.0		22	24300
-22	917		24	27250
-20	1102		26	30500
-18	1311		28	34000
-16	1590		30	38000

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## I . Introduction

As a designated manufacturer of separation machinery and equipment, our company has a nearly four-decade history of development and manufacturing of filtration machinery. Our products are characterized as advanced design, reasonable structure, and consummate fabrication process and inspection equipment. The ZJA series of two-stage high vacuum oil purifier, ZJB series single-stage vacuum oil purifier, ZJY series vacuum oil purifier, ZJCQ series turbine oil filter, ZLSG automatic water filter, LY-type series sheet frame pressure type oil filter, WLY-type micro-series oil filter, BAS-type plate and frame filter press, BAY series light filter, JYG series precision filter as well as 2CY-type, KCB-type, WCB-type series gear pump and other products manufactured by our company have been distributed widely in domestic market and are exported to more than 20 countries and regions such as Pakistan, Bangladesh, Indonesia, Thailand, Myanmar, Iran, Vietnam, Syria, the Commonwealth of Independent States, Kuwait, and Cuba. Our company enjoys a relatively high market reputation both at home and abroad. The QGZ series gas drying device designed and developed by our plant is a device, researched and developed mutually on the mutual technical advantages, to dry the gases (such as ambient air, hydrogen, hexafluoride sulfur, etc.) of industries such as electrical systems, warehouse, packaging, electronic components, particularly it may substitute the traditional transformer hot-oil circulating circulation means.

## II . Operating Principles of Gas Drying

**2.1** This gas drying device is a low-dew-point, movable, air-swept-type high-purity gas generation device comprised of air supply system, freeze drying system, adsorption dry system and PLC electric control system.

2.1.1 Composition of air supply system: comprised of air dust filter, full oil-free air compressor set, air cooler (wind cooling), moisture trap, and filter. It inputs clean gas without oil.

2.1.2 Composition of freeze drying system: The device mainly uses the full-enclosed high-temperature compression refrigeration units, performance is stable and reliable, get better cooling effect, the main by the full-enclosed high-temperature refrigeration compressor, oil separator, thermal pressure controller, cooler, solenoid valve , desiccant, thermal expansion valves and pressure gauges etc., using refrigerant R22 refrigerant.

2.1.3 Composition of adsorption drying system: Adsorption drying is from A, B 2 absorption tower, solenoid valves, gas shuttle valve, export heater, export control valves, one-way valve, pressure gauge composition.

Dry adsorbent used in adsorption by molecular sieves, silica gel color composition,

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molecular sieve as adsorbent, silica gel key observation role to play. After freeze-drying system to handle the pressure dew point at 2 °C -10 °C adsorption of gas through the drying system can be achieved after the pressure dew point -55 °C -60 °C.

2.1.4 PLC electric control system: Electrical control system adopts Japanese Mitsubishi PLC programmable controller as the core and all operations will be completed automatically... Siemens Electric (AC contactor, low-voltage circuit breaker (optional)) and Klockner-Moeller Electric (buttons, signal lamp (optional)), Hong Kong Changhui Digital-display gas flow meter (optional) are applied, which ensure the safe operation of the device.

## 2.2 The Principles and Process Equipment

First, the user device outlet should be dry and needs to connect the objects, and connect your equipment the main power supply, click the control cabinet panel: "Start" button, cold and dry machine to start (cold and dry to achieve the best cooling confidential results need to 2 minutes or so, so cold and dry to start the machine to carry out pre-cooling), PLC timing 2 minutes later, air compressor and air pre-cooling device on the 1st start on the 2nd compressor to start after 5 seconds. Two air compressors were launched, the gas supply system into working condition. 85 °C high temperature air compressor produces compressed air, through the dust to dust from the filter into the air after the pre-cooling device, the gas temperature dropped to 35-45 °C, gas, water vapor by natural temperature drop due to the role of poly-start precipitation, and then too cold and dry machine into the rapid and efficient cooling, the gas in the 90% of the water vapor deposition and low temperature and cold dry machine pipe contacts the formation of transient liquid water particles, through the gas-water separator and gas out through the steps in front of the gas after dehydration into the adsorption system.

To adsorption tower A absorption, adsorption, desorption tower B, for example, gas from the adsorption tower A solenoid valve into the bottom of the A1, from the bottom up through the absorption tower A, molecular sieve in contact with the absorbing materials (synthetic zeolite molecular sieve as raw materials, By joining the sheep willing to earth as a binder made of spherical particles, was white, the outer surface of the distribution of numerous micro-), water vapor will be adsorbed on their internal molecular sieve, the gas pressure dew point to reach the needs of post-discharge pipe through the shuttle valve equipment; and Meanwhile, from the shuttle valve as part of the pipeline of qualified leads from top to bottom of gas adsorption tower B for desorption, desorption of gas after the solenoid valve back through the B2 air compressor exhaust port. A, B adsorption tower once every 30 minutes to switch, that is, A tower absorption tower B, or B desorption absorption tower A tower of desorption. A1 and B2 solenoid valve, B1, and A2 for the same time, solenoid valve open, as long as the device is in working condition, this cycle will go on.

Also need to explain 4:

1. Adsorption desorption tower in the adsorption function can not replace the need for



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drying material to replace maintenance work, only the use of materials to extend the absorption cycle;

2. Cold and dry machine is equipped with a mandatory water-cooling device, when the devices use to the ambient temperature is higher than 35 °C, should be mandatory to connect the cooling water to ensure that cold and dry in cooling effect;

3. Outlet heater installation is optional, meaning that users need to dry gas heating can be control cabinet panel on the "heater" knob twist to the opening position, automatic temperature control heater into the working state. Of the dry gas to heat the main purpose is to enable maintenance staff to feel comfortable. Temperature-controlled upper and lower limits set by the electrical contact temperature signal pointer table settings to achieve. Use the end, add the control cabinet panel on the "heater" knob screwed to the stop position.

4. Machine working pressure range of 0-1.0Mpa. Outlet pressure regulating valve can be raised to the required working pressure.

### III. Technical Parameters

Model		QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ	QGZ
Parameter		0.3	0.6	1.0	1.5	3.0	6.0	10	15	30	60	80	100	150	200
Rated treatment capacity Nm³/min		0.3	0.6	1.0	1.5	3.0	6.0	10	15	30	60	80	100	150	200
Operating pressure		0.4~1.0Mpa 1.0~1.6Mpa													
Dew point of products		-55℃~-60℃													
Consumption of resurgent gas		3%-5% rated gas treatment amount													
Pressure loss		0.01~0.03Mpa													
Outlet temperature		0~80℃													
Regeneration mode		Thermal or apyrexia regeneration period: 10~90min													
Sorbent		Aluminum gel, allochroic silicagel, molecular sieve													
Refrigerating agent		R12			R22										
Suction drying machine	Adsorption pressure	0.35~1.0 Mpa 0.5~1.6Mpa													
	Desorption pressure	0-0.15 MPa													
Compressor HP		1/3	3/8	1/2	1/2	1	2	3	4	7.5	10	15	25	40	50
Power supply	Power	5.5	7.5	9.7	13.8	33.5	38	42	Gas supplied by air compressing station						
	Voltage	380±10													
	Phases	Three phases													
Caliber of inlet and outlet gas DN		15	20	25	32	32	40	50	65	80	100	125	125	150	200
Dimension of appearance (mm)	Long	1000	1300	2080	2080	2200	2500	2500							
	Wide	880	1660	1880	1880	1900	2200	2200							
	High	1680	1980	2200	2380	2680	2880	2980							
Net weight of equipment kg		580	680	1080	1800	2280	2800	3800							

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## **IV. Electric System and Automatic Control Function**

**4.1** The electric control system of this device adopts Mitsubishi PLC programmable logic controller as the core, start the refrigeration compressor and wait for two minutes, then the gas source system and suction drying system will automatically start up. The heater may be started according to the needs of working condition (temperature adjustable). As long as the cooling system, gas system, dry system, or heater is overloaded, the whole machine will stop automatically.

**4.2** The alternating cycle of adsorption drying system is 15 ~ 90 minutes, adsorption time is 15 ~ 90 minutes, desorption (regeneration) time is 10 ~ 60 minutes, and the dwell time is 5 ~ 30 minutes. The working procedures are as follows:

**4.2.1 Procedure 1:** Gas enters into adsorption tower A through A1 solenoid valve for adsorption process (15 ~ 90 minutes), low-dew-point and high-purity gas is output from the A3; Have part of dry gas (3%) ran through pressure regulating valve, one-way valve B4 and return to adsorption tower B to conduct desorption of adsorbent (regeneration for 10 ~ 60 minutes). Meanwhile open B2 solenoid valve and wait 10 ~ 60 minutes, then close B2 solenoid valve, the adsorption tower B conducts pressure maintaining (5 ~ 30 minutes).

**4.2.2 Procedure 2:** Gas enters into adsorption tower B through B1 solenoid valve for adsorption process (15 ~ 90 minutes), low-dew-point and high-purity gas is output from the B3; Have part of dry gas (3%) ran through pressure regulating valve, one-way valve A4 and return to adsorption tower A to conduct desorption of adsorbent (regeneration for 10 ~ 60 minutes). Meanwhile open A2 solenoid valve and wait 10 ~ 60 minutes, then close A2 solenoid valve, the adsorption tower A conducts pressure maintaining (5 ~ 30 minutes). Adsorption and desorption (regeneration) will be conducted alternatively between these two towers.

**4.3** During operating process, in case of failure of power of whole machine, all programs will be stopped automatically and reboot is required.

### **4.4 Self-adjusting function**

No manual adjustment or startup of any expansion valve, suction and exhaust valves of refrigeration system is necessary. It may operate automatically after startup and may adjust the magnitude of amount of supplied gas automatically after work; All valves of air system run automatically.

### **4.5 Protection function**

In case of over-pressure and current overload of the refrigeration compressor, the whole machine will shut down automatically; In case of over-pressure of output pressure of air compressor, air compressor stops automatically and start up automatically when the pressure dropped to a certain pressure; In case of current overload, the whole machine shuts down automatically; In case of current overload of air compressor, whole machine shuts down automatically; In case of short-circuit or overload of heater, whole machine will shut down automatically.

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## **V. Applicable Occasion**

**5.1** This gas drying device is mounted on a movable trolley and can be moved to working site for use. Large machine will be fixed and gas will be supplied by air compressing station.

**5.2** The outlet of the device through the hose with the transformer interface to link the boot after 10 minutes to the supply of dry gas to dry transformers.

**5.3** If maintenance of transformer is required, connect well the air outlet of this device with the air inlet of transformer through stainless steel hose, supply fresh dry gas to transformer (the supplied dry gas shall be guaranteed having the dew-point temperature required by the technique of transformer). Supply dry air about 2-4 operating personnel to maintain the transformer. When installing and disassembling the winding, connect well the air outlet of this device by DN20 or DN38 hose, and then distribute it reasonable to each part necessary to be dried by small-caliber hose to ensure the optimal status at any time.

**5.4** For the drying, pressuring, storage and transporting of ex-factory transformer, connect the air outlet of this device with air inlet of transformer by reducer union. When the dew-point temperature at the air outlet of transformer satisfies the requirement, close the air outlet and when positive about 105kPa forms in the transformer, close this device and valve of air inlet, to substitute nitrogen filling for storage or transportation.

**5.5** This device may be applicable to working environment where dust-free and dry air is necessary (such as electrical industry) to supply dry air of normal temperature for personnel.

## **VI. Operating Rules**

### **6.1 Operating preparation**

Check whether all connecting power supplies are three-phase 380V 50HZ alternating current, whether power supply wire can bear the power of whole device, meanwhile check whether the direction of turning of air compressor, air cooling fan is correct.

### **6.2 Operating rules**

**6.2.1** Before start up the machine set, firstly connect well the metal hose with this machine, start up the refrigeration compressor; After two minutes, air compressor, air cooler, drying machine system will “start up automatically”; Observe whether the change of pressure gauge at air inlet and outlet of refrigeration compressor is normal; When the dew point of dew-point meter (optional) reaches the required dew-point temperature, connect the another end of metal hose with equipment to be dried and adjust the pressure, flow (digital-display instrument is optional) of dry gas to the required through pressure regulating valve; The heater may be opened or not according to the requirements of working conditions, the temperature may adjusted by the temperature controller.

**6.3** Air preheater, cold and dry machines, dust filters, gas and water filters are equipped with manual drain valve, run 1-2 hours required to manually drain.

**6.4** When supply of gas is finished, press “Stop” button, then air supply system, cooling system, absorption drying system and relevant solenoid valve stop automatically.

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## **VII. Maintenance and Repair of Machine Set**

**7.1** The refrigeration system of this gas drying device is imported fully-enclosed high-temperature refrigeration compressor set. Refrigeration compressor is filled with R22 refrigeration agent, with its outlet valves normally opened. No adjustment is necessary whether the refrigeration compressor works or not.

Relevant components and parts of refrigeration system are imported Italian solenoid valve, American pressure controller, heating power expansion valve (has been adjusted when delivery), Taiwan pressure gauge respectively. Only if this machine set is power on, press “Start” button, the refrigeration system will operate automatically; Press “Stop” button, the refrigeration system will close immediately.

**7.2** The normal operating pressure of refrigeration compressor is 0.6-1.2MPa, pressure of air entry is under 0 generally, that is, under vacuum status. The pressures of air entry and air exhaust are the same under idle status, generally are 0.6-1.0MPa and related to ambient temperature mainly.

### **7.3 Leakage of refrigerant**

Breaking of evaporator heat exchange pipe caused by severe vibration, frequent open and close of solenoid valve, long-time operation will lead to the leakage and reduction of refrigerant (R22) in the system. The reduction of refrigerant will lower the refrigeration capacity of whole gas drying device and the dew-point temperature of dry air fails to reach the necessary requirement, therefore refrigerant shall be supplemented in time.

### **7.4 Addition of refrigerant**

When the refrigerant is reduced and can't reach the required normal dew-point temperature, drain off the refrigerant remained in the system, pump the system to vacuum, when pumping to -0.096MPa or so, then add refrigerant at the joint of pressure gauge connected to the inlet or air exhaust of air compressor, where the add amount of R22 refrigerant is 1.2kg.

7.4.1 Detailed operation methods are as follow:

A、Unscrew the joint of pressure gauge connected to the inlet or air exhaust of air compressor by tools and drain off the refrigerant remained in the leaked refrigeration compressor system.

B、Connect the joint of pressure gauge at suction (or exhaust) opening of compressor with high-purity nitrogen bottle by DN8-DN12 hose or oxygen pipe, fill in nitrogen with pressure about 1.2MPa, check each welding points and valve connection sealing points with soap bubble, if no leakage, proceed to next step.

C、Exhaust the nitrogen in the system, connect the joint of pressure gauge at suction (or exhaust) opening with suction inlet of vacuum pump by hose or oxygen pipe, pump the system to vacuum.

D、When the system is pumped to the vacuum degree of -0.096MP or so, unscrew the sealing cap at the lower part of suction three-way stop valve of compressor, turn the valve

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pole of stop valve counterclockwise by spanner, seal the connection point of pressure gauge, and unscrew the vacuum joint.

E、 Connect the joint of pressure gauge at compressor suction (or exhaust) opening with the steel bottle filled with refrigerant by above-mentioned hose, and place the steel bottle on the bench scale, turn counterclockwise the valve pole at the lower part of three-way stop valve by spanner, open the connection point of joint of pressure gauge, begin to fill refrigerant in the system, where the filled weight is R22:1.2kg.

F、 Finish the addition of refrigerant, turn counterclockwise the valve pole of stop valve by spanner, seal completely the connection point of joints of pressure gauge, install the joint of pressure gauge, and then unscrew it, finally seal the three-way stop valve by sealing cap.

### **7.5 Adsorption of material drying and replacement:**

Saturation absorption material after failure of equipment could no longer produce qualified pressure dew point of dry gas, and therefore the maintenance of absorbent material is very important.

First, users should regularly through the A, B two observation towers mirror to observe the color in which the color of silica gel, silica gel under normal circumstances, the appearance of dark blue, with the enhancement of water absorption will gradually become pink, Once its appearance as a pink will suffice to illustrate the adsorption tower in the adsorption material is also close to failure, the need for solutions of wave treatment.

Operation as follows: first of all need to layout a loading container on the bottom of absorption tower, is expected to play an open plug until all the shorting absorbing materials, it will leak stopper re-stuffed, the adsorption wave solution of the material need to use the oven, baking temperature 120 °C after about 2 hours so that a natural cooling, open the adsorption tower at the top flange cover feeding will be re-filled molecular sieve adsorption tower. Note that you must observe the loading position, at the viewer, you must load the corresponding position with the lens color silica gel molecular sieves and then continue up until the upper partition will be reset after the feeding flange cover, equipment can be put into use again.

## VIII. Normal Fault Reasons and Solutions

Fault	Causation	Elimination methods
Dew point temperature can't reach the requirements	1.Evaporating temperature of refrigeratory system is too high	1.Slightly turn down the suction pressure of compressor
	1.Water deposits after ice jam and evaporator of drainpipe as well as heat exchange of heat pipe are frosted	2.Heat the drain pile with hair-dryer, to defrost the pipe
	3、Oversize of gas input amount	3、Reduce the gas input amount
	4、Insulating course is damp, performance decreases	1.After heating and drying, make well surface damp-proof course
	1.Adsorption capacity of adsorbent decreases	2.Expand the regenerated amount (adjust the regenerated pressure regulating valve)
	1.Refrigerant reduces	5、Supplement or replace it after leakage inspection based upon concrete situations
Deficiency of gas supply amount	1、Humidity content of air is high, frost of evaporator is too thick	1、Open the refrigerant expansion valve to larger extent
	2、Air pipe line system not sealed tightly, air leakage happens	2、Check and adjust
	3、Connecting pipe is too long and thin, resistance is too strong.	3、Expand the diameter of hose, place the machine set to the transformer as close as possible
	4、Air solenoid valve fails to operate and does not open	4、Disassemble the solenoid valve core for maintenance
	5、Performance of air pump decreases for long-term use	5、Maintain or replace

## IX. Conversion Table of Dew Point ~ppm

Dewpoint PPm Dew point	00	01	02	03	04	05	06	07	08	09
-25	6249	6187	6124	6064	6003	5944	5885	5825	5767	5709
-26	5653	5595	5539	5484	5428	5374	5320	5267	5213	5161
-27	5109	5057	5006	4956	4905	4855	4806	4757	4709	4660
-28	4613	4567	4520	4474	4428	4383	4338	4293	4250	4206
-29	4163	4120	4078	4036	3994	3953	3912	3872	3832	3793
-30	3753	3715	3676	3638	3600	3563	3525	3489	3452	3417
-31	3381	3346	3311	3275	3242	3207	3174	3141	3108	3075
-32	3042	3011	2979	2948	2916	2885	2855	2825	2795	2765
-33	2736	2707	2678	2650	2622	2593	2566	2535	2511	2485
-34	2458	2431	2405	2380	2354	2329	2304	2279	2255	2230
-35	2206	2183	2159	2135	2113	2090	2067	2042	2023	2000
-36	1978	1958	1936	1915	1893	1874	1853	1832	1812	1793
-37	1773	1753	1734	1715	1696	1677	1659	1641	1633	1605
-38	1587	1570	1552	1535	1517	1500	1484	1468	1451	1435
-39	1422	1404	1388	1372	1356	1342	1327	1312	1297	1282
-40	1268	1254	1240	1225	1211	1198	1185	1177	1158	1145
-41	1131	1118	1106	1094	1081	1069	1056	1044	1033	1021
-42	1009	9970	9865	9752	9640	9529	9420	9311	9208	9098
-43	8993	8888	8786	8684	8583	8485	8386	8288	8192	8097
-44	8003	7909	7817	7727	7636	7547	7458	7372	7248	7199
-45	7115	7031	6949	6867	6786	6706	6627	6548	6471	6394
-46	6319	6244	6170	6097	6024	5953	5886	5811	5742	5673
-47	5605	5539	5472	5407	5342	5277	5214	5152	5090	5029
-48	4967	4908	4849	4790	4732	4675	4618	4562	4506	4452
-49	4398	4345	4291	4239	4188	4136	4086	4036	3986	3938
-50	3889	3841	3794	3747	3701	3655	3611	3566	3522	3479
-51	3435	3393	3350	3309	3269	3227	3188	3145	3109	3069
-52	3032	2993	2956	2919	2880	2846	2810	2775	2740	2706
-53	2671	2638	2605	2572	2539	2507	2475	2444	2413	2386
-54	2351	2322	2293	2264	2234	2205	2178	2150	2122	2095
-55	2068	2041	2016	1189	1963	1939	1913	1888	1864	1840



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## X. Conversion Table of Temperature of Condensed Gas Measured by Potentioneter

Reading of Potentionter (mv)	Temperature of condensed air	Reading of Potentionter (mv)	Temperature of condensed air
1.14	30.34	1.58	42.57
1.16	30.89	1.60	43.13
1.18	31.44	1.62	43.70
1.20	31.99	1.64	44.26
1.22	32.54	1.66	44.38
1.24	33.09	1.68	45.39
1.26	33.64	1.70	45.92
1.28	34.19	1.72	46.53
1.30	34.75	1.74	47.10
1.32	35.30	1.76	47.66
1.34	35.86	1.78	48.23
1.36	36.41	1.80	48.80
1.38	36.97	1.82	49.38
1.40	37.53	1.84	49.95
1.42	38.08	1.86	50.52
1.44	38.64	1.88	51.09
1.46	39.20	1.90	51.67
1.48	39.76	1.92	52.24
1.50	40.32	1.94	52.82
1.52	40.88	1.96	53.39
1.54	41.43	1.98	53.97
1.56	42.00	2.00	54.55

## XI. Dew Point and Water Content (ppm)

Dew point	Water content		Dew point	Water content
-60	13.6		-14	1892
-58	17.75		-12	2250
-56	22.9		-10	2670
-54	30.0		-8	3140
-52	36.0		-6	3730
-50	47.5		-4	4390
-48	60.5		-2	5160
-46	76.4		0	6043
-44	96.0		2	6950
-42	119.7		4	7950
-40	149.5		6	9040
-38	185.0		8	10300
-36	228.0		10	11820
-34	282.0		12	13420
-32	356.0		14	15080
-30	425.0		16	17000
-28	517.0		18	19070
-26	622.0		20	21500
-24	765.0		22	24300
-22	917		24	27250
-20	1102		26	30500
-18	1311		28	34000
-16	1590		30	38000

Extracted from “High Pure Gases”, Publishing House of Electrics Industry