



**Brrbson**

*MODULAR CLEANROOM  
SOLUTIONS MANUAL*

# 模块化洁净室解决方案

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预先设计、预先制造、预先验证的标准化模块  
以“乐高式”逻辑，现场快速灵活组合安装  
实现高科技设施的高效部署与灵活迭代

Standardized modules with predesign, prefabricated and preverification

Fast and flexible on-site assembly based on "Lego - like" logic

Achieve efficient deployment and flexible iteration of high-tech facilities

## 品牌介绍 Brand Introduction

立强金属科技旗下Berrbson创新业务的核心子品牌，由全资子公司工一智造负责运营。专注于功能性模块化行业革新技术研发,为微电子、生命科学、产学研等高科技领域客户,提供技术领先的高科技生产设施模块化一体集成解决方案。

Berrbson, the core sub-brand under Liqiang Metal Technology's innovative business division, is operated by its wholly-owned subsidiary Gongyi Intelligent Manufacturing. Specializing in the R&D of functional modular technological innovations for industrial transformation, Berrbson delivers cutting-edge modular integrated solutions for high-tech production facilities to clients in microelectronics, life sciences, academia-industry-research collaboration, and other advanced technology sectors.

**注册资本**  
Registered Capital  
**100,000,000**

**员工**  
Employees  
**200+**

**研发人员**  
R&D Personnel  
**30+**

**年生产模块**  
Annual Production  
**40000+**

## 解决方案矩阵 Solution Matrix

模块化洁净室是一种通过预制化、标准化功能单元(模块)快速搭建的洁净环境系统,以“乐高式”逻辑,将预先设计、预先制造、预先验证的标准化模块,现场快速灵活组合安装,满足微电子、生命科学领域先进生产设施对空气洁净度、温湿度、压差等参数的严苛要求,实现高科技设施的高效部署与动态调整。其核心设计理念为“可拆卸、可扩展、可复用”。

A modular cleanroom is a clean environment system rapidly assembled from prefabricated and standardized functional units (modules). Basing on "Lego-like" logic, pre-designed, prefabricated and pre-verified standardized modules are quickly and flexibly assembled on-site, meeting the strict requirements of advanced production facilities in microelectronics and life-science fields for parameters like air cleanliness, temperature, humidity and pressure difference, enabling efficient deployment and dynamic adjustment of high-tech facilities. Its core design concept is "detachable, expandable and reusable"

### 更高效 More efficient

建设周期缩短 50%-70%  
施工人员减少60%以上  
Lower capital costs  
Faster build times

### 更低风险 Lower risk

更高质量  
更安全、更绿色、更环保  
成本确定,周期可控  
Higher quality, safer and greener  
Controlling cycle

### 更灵活 More flexible

建造方式多样化  
可移动、可复用  
支持横向扩展/纵向升级,  
灵活适配业务增长需求  
Diversified construction methods  
Portable and reusable  
Scale up/out

### 更智慧 More intelligent

数字化运维  
全过程数据分析支持  
实现全生命周期管理  
Digital O&M  
PAT&RTR  
Lifecycle management

<b>N个</b> 行业/场景 Industry/Scene	<b>微电子</b> Microelectronics 半导体及泛半导体、新型显示、 电子、新能源等 Semiconductors, pan semiconductors, etc	<b>生命科学</b> Life Sciences 细胞与基因治疗/疫苗/ 单抗/ADC/无菌灌装和制剂/mRNA Cell and gene therapy, vaccines, etc	<b>产学研平台</b> Industry University Research Platform 负压间/实验室/动物房 Negative pressure room/laboratory /animal room	<b>更多行业</b> More Industries 更多场景 More scenes
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<b>"1+1"</b> 产品形态 Product Form	<b>模块化率 Modularization rate 80%+</b> 模块化微电子工厂解决方案 Modular Microelectronics Factory Solution 洁净装修部件模块 Clean decoration component module 集成吊顶系统模块 Integrated ceiling system module 机电模块 Mechanical and electrical module 工艺模块 Process module 积木式系统集成模块 (结构+装修+机电) Building block system integration module (structure+decoration+electromechanical) 二次配模块 Secondary configuration module	<b>模块化率 Modularization rate 90%+</b> 功能性模块解决方案 Functional Module Solution 细胞与基因治疗模块 Cell and Gene Therapy Module 模块化智能细胞舱 Modular intelligent cell pod 产学研实验平台 Industry university research experimental platform 快装式洁净室模块 Quick-assembly Cleanroom Module
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**6大** 核心技术服务体系  
Core Technology Service System

**产研一体的交钥匙服务体系**  
A turnkey service system integrating production and research

全系统 模块化设计 Modular design of the entire system	LOD500 数字化建模 Digital modeling of LOD500	产品功能 数字化模拟运用 Product features Application of digital simulation	自研模块化 洁净室结构 Self-developed Modular Cleanroom Structure	模块数字化 精度制造 Module digital Precision manufacturing	自研智慧管理 平台 Self-developed Intelligent Management Platform
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## 模块化GMP工厂解决方案 Modular GMP solutions

我们致力于提供符合《药品生产质量管理规范》(Good Manufacturing Practice, GMP)的预制化、可快速部署的生物制药生产设施,采用模块化设计理念,将工厂解构为标准化功能单元(模块/组件),以柔性组合方式,解决传统药厂建设周期长、灵活度低、合规成本高等痛点,为全球制药客户快速实现在不同地区部署高质量的整体模块化工厂,帮助生物制药企业快速实现工艺转移、工艺放大和产业化生产。

We are committed to providing prefabricated and rapidly deployable biopharmaceutical production facilities compliant with Good Manufacturing Practice (GMP). Adopting a modular design concept, we address the pain points of traditional pharmaceutical factory construction, such as long construction periods, low flexibility, and high compliance costs, by deconstructing the factory into standardized functional units (modules/components) and using flexible combination methods. We can rapidly help global pharmaceutical clients deploy high-quality integrated modular factories in different regions, enabling biopharmaceutical enterprises to quickly achieve process transfer, process scale - up, and industrial production

### 主要运用 Main application scenarios

疫苗与生物药: 单克隆抗体/ADC/mRNA..... Vaccines and Biopharmaceuticals: MAb/ADC/mRNA...  
 原料药 API  
 细胞与基因治疗 Cell and Gene Therapy  
 医疗器械 Medical Devices  
 其他 Others



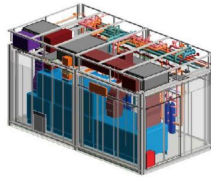
### 室外型、室内型 Outdoor/Indoor

#### 适用生物工艺场景 Bioprocessing Scenarios (BXR volume)

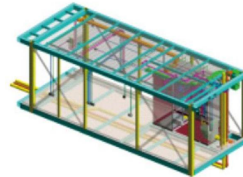
- ss > 10KL BXR
- Disposable 2kL BXR (Continuous/Batch)
- Disposable < 500L BXR
- Disposable < 50L BXR



标准化功能模块的  
厂内预制造  
(可移动结构+洁净内装  
+各机电、工艺系统集成)  
Pre-manufacturing of standardized  
functional modules within the factory



空调机房  
动力机房  
Air Conditioning Room  
Power Room



公用设施  
集成模块  
Utility Integrated Module

### 一站式交钥匙服务 Modular Service From CD to Handover



### 典型模块配置 Typical Module Configuration Scheme

模块类型 Module Type	功能描述 Function Description
核心生产模块 Core Production Module	包含反应釜、纯化系统等核心设备, 洁净等级C级/D级 Incorporates core equipment like reactors and purification systems, with cleanliness class C/D
QC实验室模块 QC Laboratory Module	集成理化、微生物检测设备, 符合GLP规范 Integrates physical - chemical and microbiological testing equipment, compliant with GLP standards
物料缓冲模块 Material Buffer Module	双向互锁传递窗、VHP灭菌系统, 实现物料无菌转移 Features two - way interlocked transfer windows and VHP sterilization system for aseptic material transfer
人员净化模块 Personnel Decontamination Module	分级更衣间(一更、二更)、风淋室 Consists of graded changing rooms (primary and secondary) and air showers
废弃物处理模块 Waste Treatment Module	灭活系统(高温/化学处理), 确保生物安全性 Equipped with inactivation systems (high - temperature/ chemical treatment) to ensure biosafety

### 模块化GMP工厂的制造与安装 Module manufacturing and installation



## 功能性模块化洁净室 Functional modular cleanroom

以工艺为核心，专门为创新医学技术、创新疗法药物的研发及生产等应用场景设计生产的功能性洁净室产品。将传统复杂的药物研发生产流程，解构为可复制、可预验证的功能性标准单元，精准控制洁净环境，封闭式保障生物安全性。通过多个标准单元的灵活配置，可快速部署、灵活扩展核心生产设施，从端到端助力再生医学与精准医疗领域产品的快速上市，造福人类健康。

当前，Berrbson研发的产品，已完全适用于500L以下的细胞培养、生物制剂生产、基因治疗等多种生产场景。

Crafted with process-centric engineering, our functional cleanroom products are specifically designed for R&D and production scenarios in innovative medical technologies and therapeutic drug development. We deconstruct traditional complex pharmaceutical workflows into replicable and pre-validated standardized functional modules, ensuring precision-controlled clean environments and closed-system biosecurity guarantees. Through flexible configurations of multiple standardized units, we enable rapid deployment and scalable expansion of core production facilities, providing end-to-end acceleration for regenerative medicine and precision medicine product commercialization, ultimately benefiting human health. Currently, the products developed by Berrbson are fully applicable to various production scenarios such as cell culture below 500L, biopharmaceutical production, gene therapy, etc.

<p><b>多种标准模块</b> A variety of standard modules B/C/D/CNC/多等级 (Multiple Grades)</p>	<p><b>符合规范</b> Compliant with specifications cGMP、ISPE、ISO、GB等</p>	<p><b>标准验证体系</b> Standard Verification System URS/RA/DQ/FAT/SAT/IOQ等</p>
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### 设施即设备 Facility as equipment



#### 厂内FAT预验证, 加速验证时间, 降低合规成本

In-house FAT (Factory Acceptance Test) pre-validation accelerates validation time and reduces compliance costs

#### 各模块系统独立, 横/纵向扩展不中断原有生产

Each module system is independent, allowing for horizontal and vertical expansion without interrupting existing productions

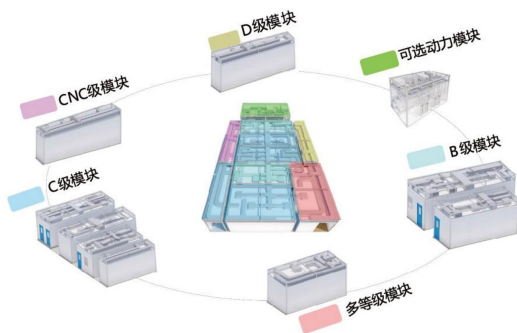
#### 覆盖药品从研发、临床到商业化生产全过程

It covers the entire process of drug development, from research and clinical trials to commercial production

#### 按设备进行资产管理折旧, 可租赁、可融资, 降低投资决策风险

Asset management depreciation based on equipment, with options for leasing and financing, reducing investment decision-making risks

### 场景运用 Application Scenarios



细胞与基因治疗  
无菌灌装  
实验室

Cell and Gene Therapy  
Aseptic Filling  
Laboratory

标准模块型号 Standard Module Models	CNC级	D级	C级	B级	多等级
长 L	6m/7.2m/8.4m/9.6m, 共4个规格				
宽 W	2.4m/3m/3.6m, 共3个规格				
高 H (m)	3.5	3.5	3.5	3.5	3.5
净高 clean height (2.6m)	3.5	3.5	3.5	3.5	3.5



#### 模块内集成九大专业系统 Nine major professional systems are integrated within the module

- ① Structure ② HVAC ③ Clean decoration
- ④ Water supply and drainage ⑤ Fire alarm
- ⑥ Strong and weak current ⑦ Automatic control
- ⑧ Process gas ⑨ Process water



#### 模块可集成各类工艺设备、家具、净化制品等

The module can integrate various process equipment, furniture, and purification products



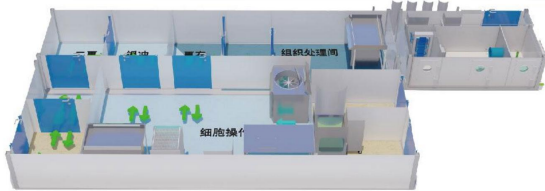
#### 智慧控制系统 Intelligent Control System

- 精准环境控制 (空气悬浮粒子、微生物限度、温度、湿度、气体 (O2/CO2)、压力)
- 封闭式设计保障生物安全, 满足BSL-2/BSL-3
- 防止交叉污染: 单向流空气、VHP灭菌系统
- 集成上下游工艺, 实现“端到端”连续生产
- 自动化与数字化运维, 全过程数据分析支持, 满足监管机构对细胞治疗产品的全生命周期追溯需求

- Precise environmental control / Airborne particles, microbial limits, temperature, humidity, gases (O2/CO2), pressure
- Enclosed design ensures biosafety, meeting BSL - 2/BSL - 3 requirements
- Prevention of cross - contamination: Unidirectional airflow, VHP sterilization system
- Integration of upstream and downstream processes to achieve "End - to - End Continuous Bioprocessing
- Automated Facility, supported by full - process data analysis, meeting regulatory requirements for the full - life - cycle traceability of cell therapy products

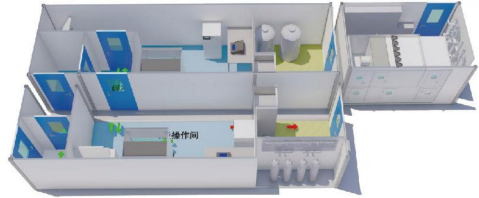
## 各类场景解决方案 Solutions

### 再生医学(干细胞)系列产品



单个干细胞生产单元 (B级, 40m2), 2个模块  
Single stem cell production unit(class B, 40m2), 2 modules

### Regenerative Medicine (Stem Cell) Series Products



双干细胞生产单元 (C级, 50m2), 2个模块  
Double stem cell production unit(Class C, 50m2), 2 modules

### 实验室系列产品



生物检测实验室(含无菌、阳性、微生物检测, C级, 200m2), 8个模块  
Biological detection laboratory(including aseptic, positive and microbial detection, Grade C, 200m2), 8 modules

### Laboratory series products



共享实验室(示例) (D级, 每间21m2)  
Shared Lab (example)(Class D, 21m2 per room)

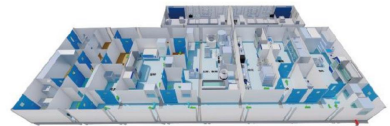
### 生命科学系列产品



细胞生产 I (B级, 60m2), 3个模块  
Cell production I(class B, 60m2), 3 modules



细胞生产 II (B级, 180m2), 9个模块  
Cell production II (class B, 180m2), 9 modules



质粒生产 (C级, 160m2), 8个模块  
Plasmid production (Class C, 160m2), 8 modules



mRNA生产 (c级, 150m2), 10个模块  
MRNA production(Class C, 150m2), 10 modules



病毒生产 (C级, 280m2), 20个模块  
Virus production(Class C, 280m2), 20 modules

### Life science series products

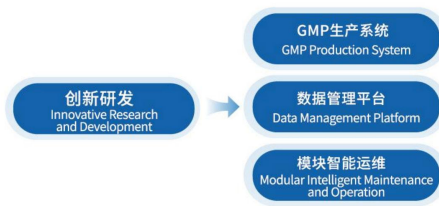
### 模块化智能细胞舱

### Modular intelligent cell pod

深度融合细胞生产与模块化洁净室技术, 真正设备化、智能化的模块化洁净室

Deeply integrating cell production with modular cleanroom technology, truly realizing a modular cleanroom that is fully equipment-based and intelligent

· 即插即用 · 可租可售 · Plug-and-play · Available for rent or sale



应用案例 Application Cases

模块化药物智造工厂

Modular Pharmaceutical Intelligent Manufacturing Factory

使用标准模块  
Use standard modules

将50多年前废旧厂房改造为  
模块化药物智造工厂  
Transform the abandoned factory  
buildings more than 50 years ago into  
Modular drug intelligent manufactur-  
ing factory

同时放置6个模块  
Place 6 modules simultaneously

用于细胞药物的快速研发/生产  
实现废弃资源升级再利用  
For rapid development/production of  
cellular drugs  
Realize the upgrading and reuse of  
waste resources

满足GMP规范  
Meet GMP specifications

面积200m<sup>2</sup>, 洁净等级B级, 满足GMP  
含洁净系统、自控、特气等  
Area 200 m<sup>2</sup>, cleanliness grade B,  
meeting GMP  
Including clean system, automatic  
control, special gas, etc.

预制率超98%  
Prefabrication rate exceeds 98%

现场8人, 快速组装, 7天完成交付  
8 people on site, quick assembly  
7 days to complete delivery



特殊环境的QC实验室模块

Modules for special environments

采用侧送侧回的气流组织  
Airflow organization with side  
feed and side return

可满足C级、D级的洁净度  
所有管电全部侧装, 检修方便  
It can meet the cleanliness of Class C  
and Class D. All pipes and electricity are  
installed on the side, which is conven-  
ient for maintenance

实现低层净高的建筑使用  
Realize the use of low-rise clear  
height buildings

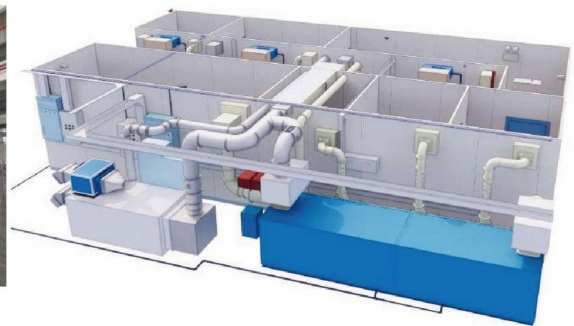
整个实验室距地总净高度3m  
降低楼层层高需求  
The total net height of the whole labora-  
tory from the ground is 3m.  
Reduce floor height requirements

架高安装更灵活  
Elevated installation is more  
flexible

底部架高, 可设置排水管道  
大大提升产品灵活性  
可复用率98%以上  
The bottom frame is high, and drainage  
pipes can be installed, which greatly  
provides product flexibility, and the  
reusability rate is over 98%

快速安装  
Elevated installation is more  
flexible

现场仅需3天交付使用  
Onsite only needs Delivery in 3 days

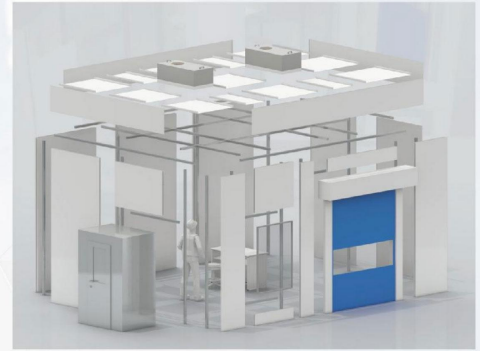


## 快装式洁净室解决方案 Quick installation modular cleanroom

由工厂预先制造的洁净室标准模块组件,像拼图一样快速拼装而成。

Pre manufactured cleanroom standard module components from the factory, quickly assembled like a puzzle.

面积: 10~2000m <sup>2</sup>	Area: 10~2000m <sup>2</sup>
洁净等级: ISO7~ISO1级	Cleanliness level: ISO7~ISO1 level
空气悬浮粒子数(≥0.5μm粒子控制)	Airborne particulate count (control of particles ≥0.5μm)
温度稳定性±0.05°C	Temperature sensitivity ± 0.05 °C
气压稳定性±0.5Pa	Pressure stability ± 0.5Pa
湿度稳定性±1%RH	Humidity stability ± 1% RH
换气次数(Class 100需≥300次/小时)	Air change rate (Class 100 requires ≥300 times per hour)



**快装式组件**  
Quick install Components

**精密自控**  
Precision self-control

**美观易清洁**  
Beautiful and easy to clean

**低能耗**  
Low energy consumption

适用于各类小规模科研实验室或局部高等级洁净室改造。

Suitable for small-scale research laboratories or local high-grade cleanroom renovations

半导体制造 | 光刻区(Class 1-10)、晶圆封装(Class 100) ...

生物制药 | 无菌灌装线(Class A/B)、细胞培养室(Class C/D) ...

医疗器械 | 植入物生产(ISO 7级)、灭菌包装区

食品工业 | 无菌包装车间(Class 10,000)、益生菌发酵区

科研实验室 | 纳米材料合成(Class 100)、PCR实验室(正压防污染)

**Semiconductor Manufacturing** | Lithography area (Class 1-10), Wafer packaging (Class 100) ...

**Biopharmaceuticals** | Aseptic filling line (Class A/B), Cell culture room (Class C/D) ...

**Medical Devices** | Implant production (ISO Class 7), Sterilization packaging area

**Food Industry** | Aseptic packaging workshop (Class 10,000), Probiotic fermentation area

**Research Laboratories** | Nanomaterial synthesis (Class 100), PCR laboratory



\* BOTHX模块化洁净室解决方案中涉及的所有产品满足各类行业标准及认证

All products involved in the BOTHX modular cleanroom solution meet various industry standards and certifications(including but not limited to)

**行业标准 International industry standards**

洁净室标准 Cleanroom Standards: ISO 14644

质量风险管理 Quality Risk Management: ICH Q7/Q9

电子记录合规性 Compliance of electronic records: FDA 21 CFR Part 11

**国际认证要求 International certification requirements**

GMP认证 Certification: EMA/FDA/NMPA

欧盟市场准入 European Union market: CE certification

生物安全等级认证 Bio-safety level certification: BSL-2/BSL-3

**Brrbson**

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