

MI Amplification

Iron Duke

Owner's Manual

1. Welcome

Hi there! I'd like to take this opportunity to thank you for purchasing the MI Amplification Iron Duke vacuum tube guitar amplifier. For me, the process of designing an amplifier is a combination of inspiration, function and vision. The Iron Duke's design process has certainly involved all of these.

In 2009, I had an idea of creating a no-nonsense, British style amplifier, a gigging workhorse. I very quickly threw together a rough idea, and took it out for a bit of a demo tour of Sydney and Melbourne. The Iron Duke was in fact one of 5 new designs I had been working on. It was a surprise, even to me, just how excited people were with the Duke. Everyone was telling me it had to go into production. "Easy," I thought,... it's such a familiar style of amp. But as often happens when I begin this process, close enough is simply not good enough. I had my ideas about the strengths and weaknesses of the British style of amp, and I wanted to create an amplifier which lived up to all the strengths, but which overcame the weaknesses.

The list of criteria I set for the Iron Duke was considerable. It had to be simple, yet flexible. Each channel and mode had to be unique, but not disjointed. It had to work with the 'classic' configuration of Les Paul and a quad box, but also had to sound great with virtually any guitar you plugged into it. It had to react well to changes in guitar volume and picking dynamics. The clean sound was particularly important on this amp, as the cleans are the usual weak point of the classic gold-face amps. It had to take pedals well. It had to be powerful enough for a typical rock gig, but not so powerful that the power amp never got a workout. The power amplifier also had to be designed to be used under extreme conditions, to give the guitarist the option of running the amp old-school,... damn loud!

So 18 months down the track, after having worked virtually every day on what I thought was a 'quick and simple' design project, I've finally reached the point where I feel happy and confident that I created the amp I envisioned at the start. It is my sincere hope that you like the Iron Duke as much as I do.

Rock on!

Michael Ibrahim
MI Amplification

2. Precautions

In order to get the most out of the Iron Duke, please make sure that you follow the points:

- Make sure that the power outlet is the correct rating as stated on the amplifier
- Make sure that if a fuse blows, you replace it with the same type and rating only. Do not substitute. Do not change any fuse while the amp is still plugged in. If your amp continues to blow fuses, get it checked out by a qualified technician.
- Make sure that the amplifier is properly ventilated, both from front and rear.
- Do not cover the cooling grill on top of the amplifier.
- Do not get the amp wet. Do not expose the amp to rain, moisture, or any water or liquid.
- Keep the amp away from any flammable objects, as the amplifier can generate quite a bit of heat.
- Do not expose the amplifier to direct sunlight or extreme heat.
- Make sure that you leave the amplifier standby in "Warm" for at least one minute after turning the power on in order to allow the power tubes to warm up properly before turning on the high voltage.
- Do not touch the tubes! They are VERY hot.
- Always make sure that the amplifier is connected to the correct load before operating.
- Always make sure that the amplifier is properly grounded by using a three-pin mains plug. Do not use a modified two-pin plug.
- Unplug the amplifier when it is not in use.
- Do not remove the back grill.
- Do not open the amplifier, as there are no user serviceable parts inside.
- Do not adjust the bias of the amplifier. This is for qualified technicians only.
- Always replace the power tubes with a good quality matched pair.
- Use hearing protection at all times if exposed to high sound pressure levels.

3. Amp Overview

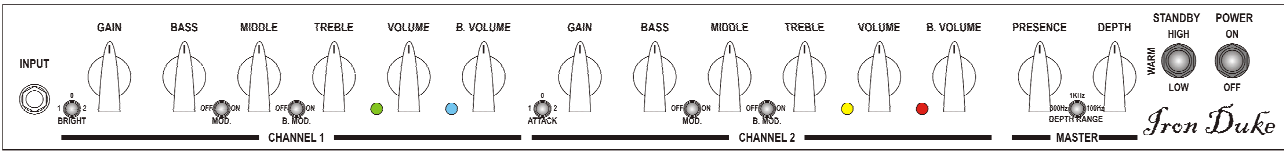


Figure 3-1 Front Panel

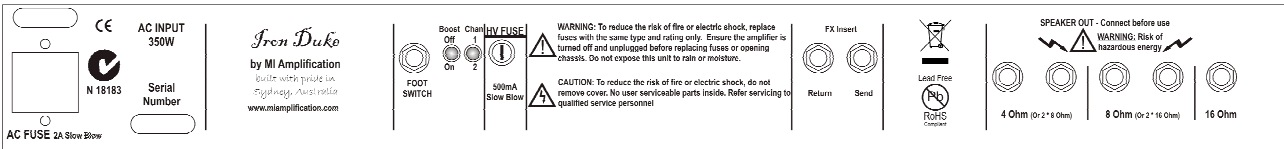


Figure 3-2 Rear Panel

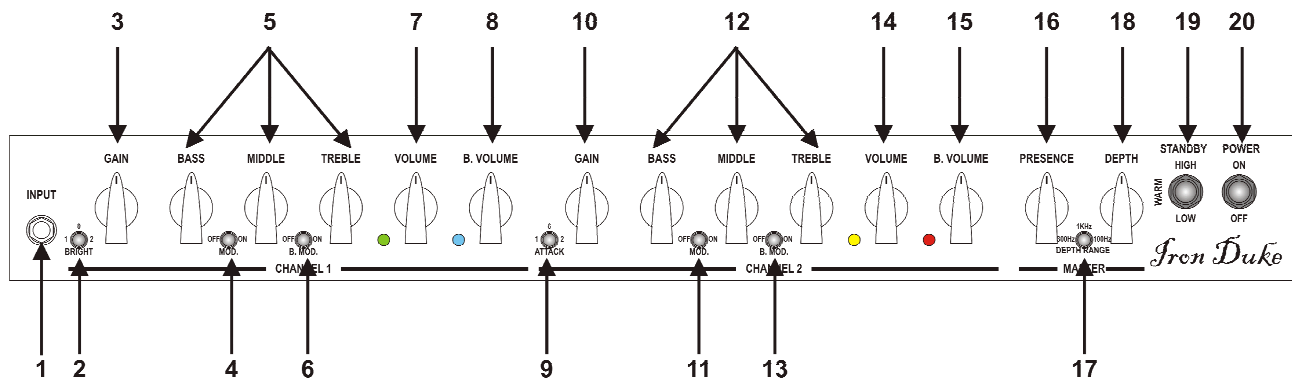
3.1. Preamp

- The Iron Duke features 2 completely independent channels, featuring **GAIN**, **BASS**, **MIDDLE**, **TREBLE**, and **VOLUME**. There is also a foot-switchable gain boost with an independent volume control (**B. VOLUME**), effectively making it a “4 channel” amplifier. We refer to these as:
 - “Clean” (Channel 1, un-boosted).
 - “Boosted Clean” (Channel 1, boosted).
 - “Overdrive” (Channel 2, un-boosted).
 - “Boosted Overdrive” (Channel 2, boosted).
- Each channel and Boost Mode has an independent **MOD** switch, for altering the voicing of the channel. So in total, there are 8 different British flavoured sounds available.
- The “Clean” channel (Channel 1, un-boosted) features a 3 position **BRIGHT** switch for fine tuning the top end sparkle. Channel 2 has an **ATTACK** switch which affects both the un-boosted and boosted modes.
- Insert series FX loop.

3.2. Power Amp

- The class A/B power amplifier uses a pair of EL34’s to generate 50W output power.
- The power amplifier also features a low power mode, which cuts the output power to 25W
- **PRESENCE** and **DEPTH** controls for controlling the power amp’s high and low frequency response.
- Unique **DEPTH RANGE** switch for tuning the depth frequency of the amplifier.
- 4, 8 and 16 Ohm outputs.

4. Controls



1. Input Jack
2. 3 position **BRIGHT** switch for the un-boosted clean mode, for setting top end sparkle
3. **GAIN** control for clean channel, shared for both the un-boosted and boosted clean
4. **MOD** switch for the un-boosted clean mode. When set to “on”, this changes the frequency response of the clean to extend the low end to make it work even better with overdrive pedals.
5. Classic tone stack for the un-boosted and boosted clean
6. **B.MOD** switch for modifying the the boosted clean. This famous 80’s hot-rod adds more saturation. When on, you’ll need to increase the Boost Volume (8) to compensate for the extra saturation.
7. **VOLUME** is the master volume control for the un-boosted clean. When the green LED to the bottom left of the control is on, it indicates that the un-boosted clean is active.
8. **B. VOLUME** This is the master volume control for the boosted clean. When the blue LED to the bottom left of the control is on, it indicates that the boosted clean is active.
9. **ATTACK** switch for the un-boosted and boosted overdrive. Set this to match your guitar. Generally, humbuckers sound good set to “1” or “2”, while single-coil pickups sound better set to “0” or “1”
10. **GAIN** control for overdrive channel, shared for both the un-boosted and boosted overdrive.
11. **MOD** switch for the un-boosted overdrive. This famous 80’s hot-rod adds more saturation. When on, you’ll need to increase the **VOLUME** (14) to compensate for the extra saturation.
12. Classic tone stack for the un-boosted and boosted overdrive
13. **B.MOD** switch for modifying the boosted overdrive. This famous 80’s hot-rod adds more saturation. When on, you’ll need to increase the **B.VOLUME** (15) to compensate for the extra saturation.
14. **VOLUME** is the master volume control for the un-boosted overdrive. When the yellow LED to the bottom left of the control is on, it indicates that the un-boosted overdrive is active.
15. **B.VOLUME** is the master volume control for the boosted overdrive. When the red LED to the bottom left of the control is on, it indicates that the boosted clean is active.
16. **PRESENCE** control for adjusting the top end detail of the power amp
17. **DEPTH RANGE** switch, for tuning the effective frequency range of the **DEPTH** control (18)
18. **DEPTH** control for adjusting the low frequency response of the power amp.
19. Standby switch. “Warm” is used to allow the amplifier to warm up when it’s first turned on. “Low” produces a maximum of 25W clean. “High” produces a maximum of 50W clean.
20. Power switch.

5. Setup and quick-play guide.

- Unpack the amplifier head and make sure that you remove ALL packing material.
- Connect an appropriate speaker to the correct speaker output.
- Connect the power plug into the amplifier.
- Plug your guitar into the front of the amplifier, along with the two button footswitch into the rear of the amplifier.
- Turn everything to 50%, except for the channel volumes and boost volumes. Turn these all the way down.
- Set the **DEPTH RANGE** to 300Hz
- Turn the amp on and leave the amp's standby in "Warm" for at least two minutes after turning the standby on in order to allow the power tubes to warm up properly.
- Set the **STANDBY** switch to "High".
- Start with the boosted clean channel. Slowly turn up the **B.VOLUME** control, and set the gain control to achieve the desired amount of break up. If you require more saturation, switch on the mod for the boosted clean ("**B.MOD**" switch), and increase the **B.VOLUME** to compensate for drop in volume.
- Next, switch to the un-boosted clean, and set the bright switch to achieve the right level of top end detail. If you require more low end, switch the **MOD** switch on. Since the EQ is shared for the boosted and un-boosted 'channels', you will need to find the right setting for you achieve the right balance between these two sounds.
- Next, switch to the overdrive channel. For the un-boosted overdrive, set the attack switch to get the right sound for your guitar. If you need more saturation, switch on the **MOD** switch for the un-boosted overdrive, and adjust the channel's **VOLUME** control.
- Now, switch to the boosted overdrive, and make sure that the attack switch setting is suitable here as well. Again, if more saturation is required, switch on the **B.MOD** switch for the boosted overdrive, and adjust the channel's **B.VOLUME** control.
- Finally, experiment with the **PRESENCE** and **DEPTH** controls, as well as the **DEPTH RANGE** switch to get a sound you like. Remember, as these controls affect all channels, you need to check all 4 sounds.

6. The Channels

6.1. Channel 1 (Clean) Un-boosted

As mentioned in the introduction, the clean sounds on some British style amps are not their best features. At best, they can be lack-lustre and not very inspiring. With the Iron Duke, I wanted to create a clean channel with firstly produced a beautiful, crystalline, almost combo-like clean (which could be pushed into overdrive), and secondly, was the most pedal-friendly platform I had created to date. So for this channel, my inspiration came from the chimey, lower wattage 'Class A' amps.

Selecting the Clean Un-boosted Channel

There are two ways to activate the clean un-boosted channel:

1. Switch the channel select switch on the rear panel to "Chan. 1", and the boosted switch to "off"
2. Plug in the supplied two button footswitch, and switch both buttons off (channel and boost).

When the clean un-boosted channel is selected, the green LED on the front panel should be on, and the corresponding **VOLUME** control should be active.

Gain Control

The clean channel's gain range was designed to take you from sparking clean, to a slightly pushed breakup, and with high output pickups, a classic crunch. It is very sensitive to picking dynamics and pickup output. So the point at which breakup occurs varies from guitar to guitar. With typical single coil pickups, the signal will clip with the gain control set to 2 to 3 O'clock. With average humbuckers this happens at around 12 O'clock, and with high output humbuckers, around 10:30.

Bright Switch

The three position bright switch can be used to add a subtle shimmer, or a more pronounced high boost to the tone. In the middle position, the bright switch is off. This is a good choice for brighter pickups. The first position "1" adds a slight shimmer to the top end, and works like a bright switch you'd find on a traditional American style amplifier. I use this for my normal bright sound. The last setting "2" is brighter still, and a good choice for very dark pickups.

Tone Note: The higher the gain is set, the less effective the bright switch becomes.

MOD Switch

The development of this function for the un-boosted clean was quite interesting. At first, it was going to be a saturation switch (like the other "Mod" switches). However, there were two issues I faced during the design process. The first was that extra saturation didn't suit the voicing of the un-boosted clean. Secondly, I found that there was a difference between a 'pure' clean and a 'pedal-friendly' clean. Because of this second point, I actually found voicing this channel rather difficult. If I created a great 'pure' clean, I found that using pedals in the front (especially compared to the overdrive channel) sounded a little bit too thin. If on the other hand I tuned clean to make it an excellent pedal platform, I found that the pure clean sounds were a bit too thick in the low end. Dialling this out with the channel's EQ would then obviously have an effect on the boosted clean.

So in the end, I came up with the current implementation. When the **MOD** switch is off, the low end of the un-boosted clean is controlled, and in fact, shaped to give this channel an almost 'combo-like' response, even through quad boxes. When the **MOD** switch is on, not only does the low end increase, but the EQ response is extended lower to really fill out the sound. This really adds wonderful depth and 'momentum' to overdrive and distortion pedals when used with this channel.

Of course, you're free to experiment. You may very well find that you prefer the clean channel with the extra bass activated, or alternatively, you may find that you like the tighter low end of the **MOD** off with pedals.

Bass, Middle, Treble

There are no rules here,... adjust to taste! The only thing to keep in mind is that since the EQ is shared for both the un-boosted and boosted clean sounds, you will need to fine-tune the settings to achieve a sound you will like to both modes.

Volume Control

Depending on the guitar and pickups you're using, you will need to adjust the output volume to balance with the other channels and modes. Generally, the un-boosted clean volume will be set higher than the other channels and modes.

6.2. Channel 1 (Clean) Boosted

The boosted clean channel is one of my favourite sounds on the Iron Duke. It's an interesting extension on the clean sound, but has been shaped for a fat, old-school rock sound. This is a great sound for rock rhythm sounds, or fat blues.

Another great feature of the boosted clean is how well it takes pedals. It has a unique ability to fuse the tone of the overdrive or distortion pedal with its own natural midrange purr.

Selecting the Clean boosted Channel

There are two ways to activate the clean boosted channel:

1. Switch the channel select switch on the rear panel to “Chan. 1”, and the boosted switch to “on”
2. Plug in the supplied two button footswitch, and switch right ‘Boost’ button on.

Gain Control

The character of the **GAIN** control for the boosted clean is quite different to the un-boosted clean. In boosted mode, it behaves much more like the bright channel on the classic British amps. The gain comes on quickly, and adjusting the **GAIN** has more of an effect on the body of the sound. To set the **GAIN** control to the optimal setting, it’s best to try to achieve the right ‘feel’, as opposed to going for a particular level of gain. Feel free to experiment with the whole range of the gain control. I personally find that about 1 O’clock is a pretty sweet spot.

Because this control is shared with the un-boosted clean mode, there are a few ways to set the appropriate gain level:

1. If the boosted clean is the main priority, then set the amount of gain you require in boosted clean. When you switch to the un-boosted clean, you can then use the guitar’s volume control to adjust the amount of ‘hair’ the un-boosted clean has (assuming it’s too much that is!).
2. Alternatively, you can employ the **B.MOD** switch to add more saturation to the boosted clean, and then run the gain control lower, so that the un-boosted clean stays truly clean.

B.MOD Switch

The **B.MOD** switch activates the hot-rod mod for this channel. Based on a classic 80’s gain mod, this introduces extra clipping at the end of the preamp. For the boosted clean, this pushes the tone of the amp more towards a modern voicing. Please note that with the **B.MOD** turned on, the output volume will decrease, and the **B.VOLUME** control will need to be turned up to compensate.

Bass, Middle, Treble

For the boosted clean, the EQ is revoiced to give it a nice midrange bark. Once again, it’s important to experiment with the EQ on this channel to find the right balance for the clean and boosted clean modes.

B.VOLUME

The boosted clean mode is all about old school rock tones. As such, the louder the amp is played, the better it sounds! So while there are no hard and fast rules associated with setting this volume, my personal preference is to try to run this volume about 1 O’clock. I find that they’re a really nice synergy between the preamp and power amp at this setting, and the old-school attitude of the boosted clean really comes to the fore. If the amp is too loud in this setting, try running it in low power. If it is still too loud, fear not: the Iron Duke will still sound amazing with the **B.VOLUME** set lower.

6.3. Channel 2 (Overdrive) Un-boosted and Boosted

The un-boosted overdrive channel is another personal favourite of mine. I worked really hard on voicing this particular channel, because I knew that this was where many players would spend a lot of their time. It’s the perfect in-between channel. Dig in hard, and it really growls. But back off the volume, and pick lightly, and you’ll swear you’re back on the clean channel! In fact, sensitivity to guitar volume was one of the prime objectives of the way this channel’s voiced. Accordingly, the tonal ‘stance’ of this channel is very balanced, with just the right amount of colour in there to make it unmistakably ‘British’.

The Boosted overdrive channel takes off where the un-boosted left off. A slightly tighter low end, a very full midrange makes this channel not only a serious crunch machine for rhythm guitar, but also helps create a wonderful, full, singling lead sound, swirling with harmonics.

Selecting the Un-boosted Overdrive Channel

There are two ways to activate the un-boosted OD channel:

1. Switch the channel select switch on the rear panel to “Chan. 2”, and the boosted switch to “off”
2. Plug in the supplied two button footswitch, and switch left “Channel” button on, and the right ‘Boost’ button off.

Selecting the boosted Overdrive Channel

There are two ways to activate the boosted OD channel:

1. Switch the channel select switch on the rear panel to “Chan. 2”, and the boosted switch to “on”
2. Plug in the supplied two button footswitch, and switch left “Channel” button on, and the right ‘Boost’ button on.

Gain control

When set to un-boosted overdrive, the **GAIN** control has a very wide range. Set it between 9 and 10 O’clock, and set the **ATTACK** switch to “1”, and you have a genuine alternate clean channel. Seriously! Try it out. It certainly has its own character, but switching between the overdrive and clean will reveal just how balanced this overdrive channel really is.

At 12 O’clock, the overdrive will starts to pile on, and by the time you hit 5 O’clock, the tone will be fat and creamy, with a healthy sustain. An important note is that the **GAIN** control, in conjunction with the **ATTACK** switch is also a very powerful tone shaping tool. So when experimenting with **GAIN** settings, don’t forget to also adjust the **ATTACK** switch.

For the boosted overdrive mode, there is a considerable increase in gain. Whilst the tonal balance is retained, and the gain control works just like it does in un-boosted overdrive, the emphasis is much more focused on the midrange frequencies.

ATTACK switch

My primary objective with the attack switch was to improve the flexibility of the Iron Duke, but allowing the guitarist to better match the top end bite of the overdrive channel to different guitars. For brighter guitars, particularly with single coils, the “0” or “1” positions tend to work best. Position “1” is a great position if you also want to roll back the guitar’s volume control to get a clean sound. The “2” position is great for darker guitars, in particular with humbuckers. This helps keep the sound tight and focused, and also adds a good dose of upper midrange gain. However, there are no rules to setting this. Just use your ears. You may very well like the bite and sting of position “2” with single coils, or alternatively, the fat, throaty tones of position “0” with humbuckers.

MOD and B.MOD Switch

The **MOD** switch activates the hot-rod mod for the un-boosted overdrive channel, whilst the **B.MOD** switch activates the hot-rod mod for the boosted overdrive channel. Once again, this is based on a classic 80’s gain mod, and introduces extra clipping at the end of the preamp. However, for the overdrive channel, this is even tighter and revoices the channel into a more modern sounding channel, without disturbing the overall frequency content. Please note that with the **MOD** and **B.MOD** switches turned on, the output volume will decrease, and the respective volume controls will need to be turned up to compensate.

Bass, Middle, Treble

For the overdrive channel, the EQ is based on the classic 80's British amps, but with a more muscular lower midrange.

Volume Control

As with the boosted clean channel, I really like the sound of this channel when the power amp starts to work a bit harder. This will start to happen between 11 and 12 O'clock. Don't forget the low power option for getting a cranked tone at a more reasonable volume. Once again, you can always set the output volumes lower for more reasonable sound levels, and the amp will still sound great.

7. FX Loop

The series insert loop in the Iron Duke is designed to work with high quality line level effects with high input impedance. The loop is engaged automatically when the effects are plugged into the send and return of the amplifier. This design ensures the purest signal path when no effects are used, mimicking the **exact** signal path of vintage amps. For added flexibility, try using a dedicated loop interface to allow you to change send and return levels.

8. Presence and Depth Controls

The **PRESENCE** and **DEPTH** controls on the Iron Duke are important tone shaping tools for the overall tone and feel of the amplifier. The **PRESENCE** control is designed like to work like the classic British presence control with the same taper and response. It affects the high frequency response of the power amplifier. The **DEPTH** control controls the low frequency response of the power amplifier. Importantly, it also controls how 'loose' the physical low end response of the speakers will be.

One thing that sets the Iron Duke apart from any other amplifier is the **DEPTH RANGE** switch. This switch came about during the prototyping phase, when we were trying to tune the **DEPTH** control. The 'standard' approach to the depth control is to focus only on the lowest frequencies, below 100Hz. This historically came about because amp designers were trying to increase the 'thump' their amps delivered. For the Iron Duke, we found that this design worked well if you were going for more of a 'metal' sound from the overdrive channel, or if you wanted to fill out the lowest frequencies of the clean sounds. However, the sounds I was envisioning were fatter, with a strong, round, lower midrange emphasis. So we experimented with widening the range of the depth control to control frequencies up to 300Hz. This sounded awesome! So pushing things even further, we extended the range of depth even further to 1KHz. What a sound!

Our dilemma then was which one to go for? Traditional low end thump, fat lower mids, or a 'full' midrange boost? In the end, we came up with the current implementation, i.e. all of the above! With this design, you have the ability to choose the depth response you want.

As mentioned above, setting the range to 100Hz is great for adding thump to your low end for higher gain rhythm sounds without increasing the 'density' of the tone. This is also great for the clean sounds. Setting the range to 300Hz will fatten up the tone without adding too much sizzle. This is the best 'all-rounder'. At 1KHz, the depth control will affect the main body of the sound.

One of my personal favourite settings, especially for overdrive is the 1KHz setting, with the depth all the way up. You then add presence till you achieve the high frequency content that you want. Check it out!

One word of caution though: the louder the amp is, the less depth is required. My rule of thumb is to use only as much depth as you need, but not more. Very bassy tone may sound great on their own, but tend to get lost in a band mix.

9. Speaker outputs.

The Iron Duke features a full suite of speaker outputs. The Iron Duke can drive 16Ohm, 8Ohm, and 4Ohm total load.

Please note: The Iron Duke is a high performance vacuum tube amplifier, which is designed to extract optimal performance from the power tubes. This means that it is imperative that you use the correct load connected to the speaker outputs.

Very important!!! **YOU MUST ALWAYS HAVE A SPEAKER LOAD CONNECTED TO THE AMPLIFIER.** Failure to do so will almost certainly result in damage to the amplifier.

The available configurations can be summaries are follows:

- To connect one 16 Ohm cab, connect it to the 16 Ohm speaker output.
- To connect two 16 Ohm cabs, connect them to two 8 Ohm speaker outputs.
- To connect one 8 Ohm cab, connect it to the 8 Ohm speaker output.
- To connect two 8 Ohm cabs, connect them to two 4 Ohm speaker outputs.
- To connect one 4 Ohm cab, connect it to the 4 Ohm speaker output.

10. For Your Amp Tech

The Iron Duke is designed to use EL34, KT77 or 6CA7 tubes. I recommend a cathode bias current of 35mA. Do not exceed 40mA per tube. There are two bias potentiometers, one for each power mode. The high power mode should be biased first, and is adjusted with VR01 which is located between the power tubes. The low power mode bias is adjusted with VR02, which is located to the right of the power tubes.

WARNING: Biasing the Iron Duke should only be done by an experienced tech, as all the bias adjustments and measurements are done inside the chassis. The high voltages at which the Iron Duke operates makes it potentially lethal to anyone who is unqualified or careless.